Science & Mechanics

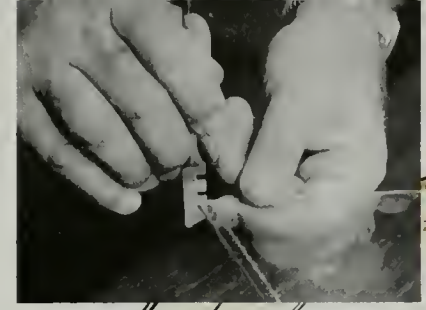
Complete HANDYMAN ENCYCLOPEDIA

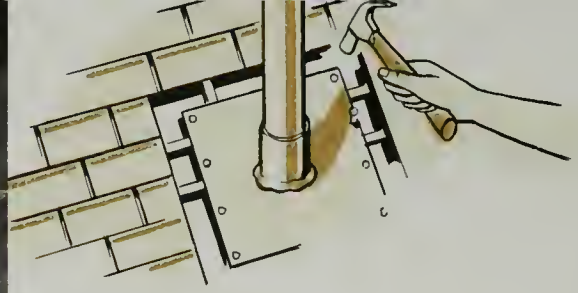
9

GARDENING
HOME IMPROVEMENT

Do-It-Yourself

Complete Handyman do-it-yourself Encyclopedia





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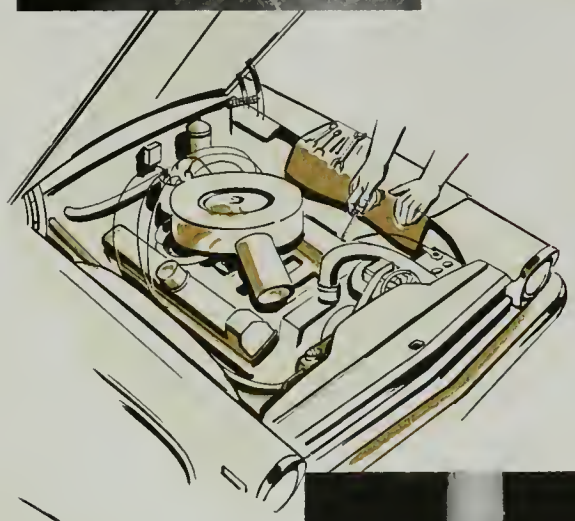

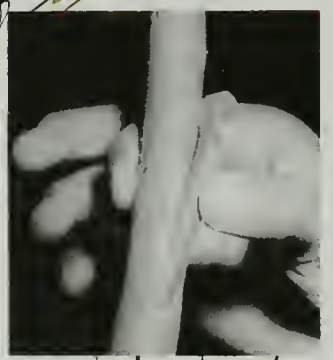

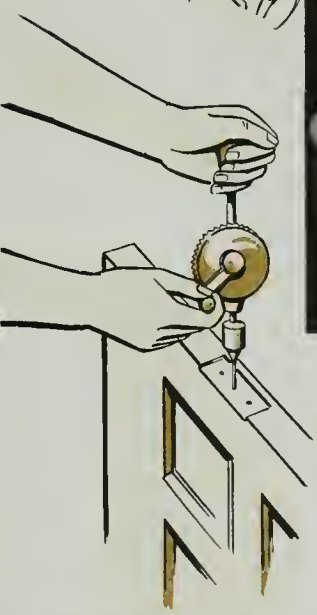

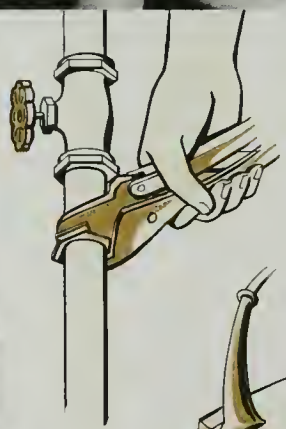

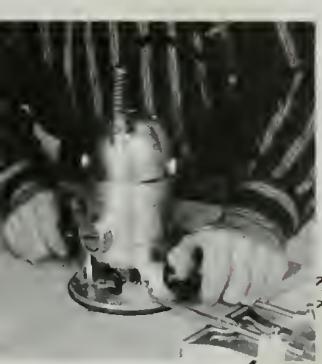

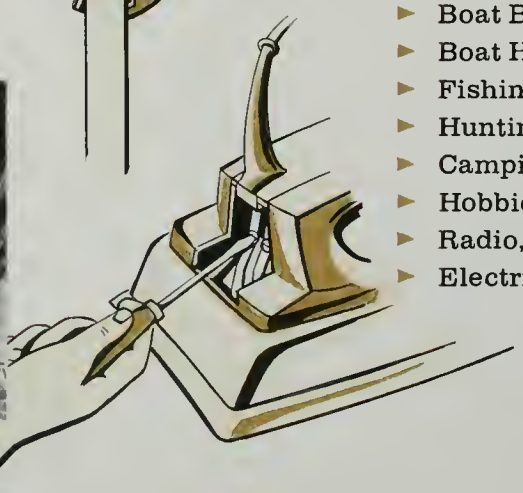

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Complete Handyman yourself Encyclopedia

A COMPILATION OF NEW AND PREVIOUSLY PUBLISHED SPECIAL INTEREST PROJECTS AND MANUALS FOR THE REPAIR AND CARE OF HOMES, AUTO, APPLIANCES, HOBBY EQUIPMENT.

by the editors of

Science & Mechanics

9

GARDENING

HOME IMPROVEMENT

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Use your fingers, rather than a knife, to separate and lift individual seedlings out of a nursery flat; you may lose soil this way, but you keep more roots.

Green Thumb Tips

A healthy garden calls for real planting know-how. These hints will add a professional touch to your selection and care of plants

KEEP YOUR HANDS off wet plants. Bacteria, fungus spores, and other invisible pests may be suspended in the moisture on the leaves. Touching one plant, then another and another, can make you the horticultural equivalent of Typhoid Mary.

Here's how to turn one shrub into a full hedge—eventually. Select a low-growing branch that can be bent to the ground. Mark a point on its underside—just below a joint and about 10 to 12 inches from the end. Dig a four-inch-deep hole in the ground directly under that point, and line it with rich soil. Now, at the point you marked on the branch, make a slanting cut halfway through, and wedge the cut open with a pebble. Bend the branch into the hole, with the cut part deepest; the end of the branch will stick up, and should later be staked. But first anchor the cut part in place with a wire loop, fill the hole with soil, and put a stone on top. Then wait. After a

gardening, indoor: see fluorescent lighting
gardening, organic: see organic gardening
garden lighting: see lighting

season or two, the cut part of the branch will probably have established a new independent root system, and you've got yourself a brand-new shrub.

Stake tall flowers and viney vegetables before they need staking, not after. Best way for most plants: an 8-shaped tie, with one loop around the plant, the other around the stake.

Two ways to protect plants from slugs: Sprinkle a strip of wood ashes or gritty sand around the bed or border; dig a saucer into the ground nearby so that the rim is at ground level, then fill it with beer. All the slugs in the neighborhood will come to the party (and when you get there, the party's over).

Protect newly-set plants from sun and wind by making temporary shelters. Two easy ones: "pup tents" made of newspaper and anchored with handfuls of soil; wood or cardboard "shingles" stuck into the ground on the sunny side of the plants.

When you buy nursery plants in containers, avoid any that look rootbound. The evidence: roots growing up above the soil level or down through the container's drainage holes. Also avoid plants with unusually large tops, unusually leggy stems or trunks, or a noticeable percentage of dead twigs and branches, all of which indicate crowded roots.

Some gardeners use a putty knife or a spatula to separate and lift the individual seedlings out of a nursery flat. Green thumb gardeners use their fingers, tearing very gently as required; you lose some soil that way, but you keep more roots on the plant.

If you grow lettuce and other leafy vegetables, harvest them around noon if the weather is clear, in the late afternoon if it's cloudy. According to the U.S. Public Health Service, that's the best way to get them with maximum vitamin content.

With bulb-type plants, you can't afford to be an impeccable housekeeper. *Don't* cut the foliage down while it's still green; wait until it's good and yellow. Those yellow leaves are storing up food for the next year's blooms. If you really can't stand the way the foliage looks, bind it up with a rubber band or pin it to the ground with a U-shaped piece of wire. Or conceal it with some quick-growing annual.

Other things being equal, buy nursery plants in tapered cans rather than cans with straight sides. They're easier to tap out without cutting the can, will usually slide out in one neat, undisturbed clump.

To get a traditional-looking vine-covered cottage without waiting the traditional number of years, fan the vine's branches out horizontally and secure them in place with staples, eye bolts, or whatever. In addition to quicker coverage; you'll get more blooms on flower-bearing vines: horizontal training stimulates the growth of lateral branches, and lateral branches usually produce more flowers.

Protect newly-set plants from sun and wind by making shelters like this "pup tent." All it takes is newspaper and a few handfuls of soil.

When you sow seeds in rows, slant the rows in the direction that takes maximum advantage of the sun's path. When the row goes north-to-south, you'll get equal sunlight on both sides.

Keep a bucket of oiled sand near your tool shed or storage rack. Scrape the dirt off your tools as soon as you're through working with them, then work each tool up and down in the sand before you tuck it away. That way your tools will always be clean and covered with a thin film of oil.

If you move indoor plants outdoors for the summer, do it on a day when it's about as warm outdoors as indoors, and put them where the light is just about as strong as what they're used to. In short, it's okay to change their environment, but do it gradually.

Don't worry about the possibility of polluting your organic garden by using non-organic kitchen scraps in your put-it-back program—like leftovers from store-bought vegetables. Although most such produce was originally treated with synthetics and poisons, organic scientists say the deadly compounds will be broken down by micro-organisms in the soil as the scraps themselves decompose; very little (and probably none) will be taken up by new plants. To be super-sure, though, you can compost non-organic wastes first, rather than applying them directly to the soil.

Pine needles are too acid for many plants, but they're a great mulch for acid-loving berry bushes. One way to get them: clip the branches off your Christmas tree and lay them under the bushes. If that's not enough, offer to take care of your neighbors' old Christmas trees, too. (The trunks are good for firewood.)

Some moles eat plants and some moles eat bugs, but all dig underground tunnels that can heave up seedlings, destroy tender roots, and wreck a lawn. If you see signs of a mole (ridges of raised, cracked soil, plus little conical mounds of dirt), you'll

Kitchen scraps are ideal for your put-it-back program. Even synthetics or poisons on store-bought fruits and vegetables will be broken down in decomposition and won't harm plants.

Before you put garden tools away, work them up and down in a bucket of oiled sand to keep them clean and rust protected.

probably want to get rid of it. Before you start messing with traps, try this simple act of un-hospitality: Set a coke bottle into each of the surface holes (they're under the dirt mounds), with a portion of the top left above the ground. If there isn't a hole, break into the tunnel (right under the ridge) and set it there. When the breeze blows it whistles through the bottles, vibrates through the tunnel and generally sends the mole off to greener pastures.

Thinking of starting your first vegetable patch? Here's a good combination of crops for first-timers: green or wax beans, tomatoes, cucumbers, summer and winter squash, plus a few onions and/or chives to help keep pests away. Reason for the choice: all those crops are prolific and fairly easy to grow, which means you're not likely to be discouraged the first time out; and they should all be planted fairly late, which gives you time to make a little compost to dig into the ground before planting.

One way to stop worrying about weeds: stop calling them weeds. Example: the milkweed, which is a delicious dinner vegetable. Gather the young shoots, rub off their thin "fur," then cook them like asparagus.

If you're broadcasting flower seed in drifts or patterned plantings, mix the seed with several times its bulk of fine sand. This way you'll be assured much more even distribution.

Bare-root planting in winter and early spring usually saves you money (the plants cost about half as much as they will later) and often results in healthier, more vigorous growth. But in order to work, the roots have to be live-looking and plump, not dead-looking and dry. When in doubt, soak the roots overnight in a bucket of water, then plant.

Here's one of the oldest saws in gardening, and it still applies: When you're pruning, never leave a stub you can hang your hat on.

See also FERTILIZERS, FLOWER CARE, FLOWERING BULBS, GARDEN PLANNING, TOOLS, GARDEN.

▲ Foliage on bulb plants should be cut after it's turned brown and yellow. It will look like this when foliage looks right. Dig it up with rubber gloves (above) or pull it to the ground.

How to Root Cuttings

This easy-to-build rooting tub will improve your chances of success

If you have difficulty rooting cuttings you may have failed to water them regularly and literally wore them out digging them up every few days to see if they had rooted. If you use the self-watering propagation tub shown here, you should have much better results.

How to take cuttings. You may have to experiment a bit to determine how mature the cuttings should be before trying to root them. If they are too soft and succulent, they probably will wilt. If they are too hard and starting to get woody, as in the case of shrubs and evergreens, they will take too long to root. Using a very sharp knife, make the cuttings about two inches long. If shorter, they are hard to handle; if longer, they may wilt. Leave on the foliage.

Inserting cuttings. With a knife, cut a slit in the sand one inch deep, using a two-inch wide strip of wood as a guide. Into this slit place the cuttings, one inch deep and ½-inch apart. When a row is complete, firm sand around base of cuttings by pounding the wooden slat with a hammer. This eliminates air pockets.

When you have filled the tub or used up all your cuttings, place the tub in a shaded place beneath a tree or shrub or on the north side of a building. Avoid very windy or drafty places as the cuttings may wilt. Depending on the kind of plant, hardness or softness of cutting, as well as temperatures, cuttings should root in from 10 days to three or four weeks.

Care after rooting. When the roots are ½-inch long, dig them out, don't pull. Don't let cuttings dry out. Keep them shaded with

a moist newspaper or peat moss while planting.

Since most of the new plants will be rather slow getting started, plant them away from large, established plants. Some of the cuttings may be potted in 2½- or 3-inch clay pots, which can be plunged to their tops in sand, peat or weathered sawdust. Unless in a cool northern climate, shade potted cuttings under cheesecloth, muslin or even snow fencing.

Best potting mixture is two parts soil and one part peat, leafmold or well-rooted manure. Once plants start growing in pots, fertilize with a complete fertilizer every two months during the growing season. Use ¼ pound per square yard of bed surface.

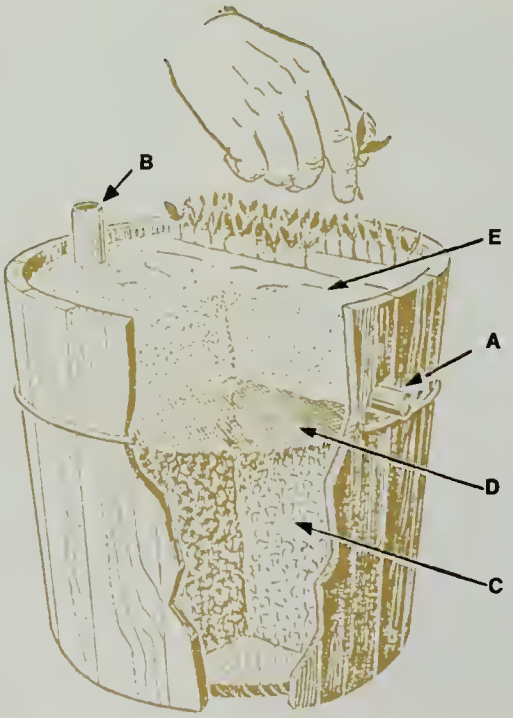
Kinds of cuttings to use. Many hardy shrubs can be rooted from two-inch cuttings taken from the tips of the branches during late June or early July. This often works with cotoneaster, euonymus and viburnum. Try it also with dwarf flowering quinces.

Some evergreens can be grown from two-inch cuttings made from tips of new growth during late June or early July. Try it with junipers, Hinoki cypress, yew and arborvitae. You may have trouble rooting hemlock, spruce, pine or fir in this manner.

Broadleaf evergreens are worked in the same manner as the others. Try boxwood, Japanese spurge, fire-thorn, Japanese holly, wintercreeper and English ivy, but don't expect much from rhododendron, American holly, mahonia and evergreen azalea. Plantlets growing along the flower stems of daylilies and St. Bernard's-lily may be quickly rooted in the tub.

House plants can be rooted any time during the summer, but why not wait until after you have the hardy plants out of the way. Then try coleus, begonia, impatiens and African violets. Bring the tub indoors before frosty nights begin. V.H.R.

See also: GARDEN PLANNING; TOOLS, GARDEN; GRAFTING.



➤ *To make a self-watering propagation tub, start with an ordinary pail. Make a small hole in the side about 3 inches below the rim (A) and insert a tube to drain excess water. Stand a 3/4- or 1-inch pipe in the pail opposite the drain hole (B) and fill the pail with washed gravel or crushed stone (C) to just below the drainhole. Cover it with a piece of burlap or window screen (D) and fill the rest of the pail with washed sharp sand (E). Pound the sand with a brick or stone to make it firm. Pour water in the vertical filling tube until it flows out the drain hole. It should not be necessary to water more than twice a week.*

How to Prepare Your Garden for Winter

Care in the fall will give you a healthier garden the following summer

BEFORE YOU SETTLE DOWN for the winter, glance over this checklist just to see if you have given your garden its winter insurance policy—and put it to bed with the kind of care that will make you proud and happy come next spring and summertime.

Fall planting. If you live in the northern tier of states, November is your last chance to plant early spring-flowering bulbs. Set the bulbs in rows or clumps. A handful of stabilized compost placed under each bulb will supply all the plant food needed. Mulching with two to three inches of dried leaves over bulb planting areas will help the soil maintain a uniform temperature, and thus prevent heaving of the soil which often pushes shallowly-planted bulbs too close to the surface. The mulch, however, should be removed in early spring or it will promote too early growth of the bulbs. In fact, crocuses may come up under the mulch and not even be seen if the mulch is left on too long.

Fall garden protection. Plants native to your area require little or no protection from wind or cold. However, plants from other areas may need protection from poorly drained, water-soaked soils, sweeping winds and extreme cold.

In northern states both rose shrubs and climbers should be protected against cold winds, sleet and extreme changes in temperature which occur because of cold nights and sunny days. Mound the soil up at the base of the plant to a height of six to eight inches and erect a shelter about the plant, filling it with dried leaves. A basket through which air can circulate can be used to cover small bushes. Wrap climbers with burlap and tie to a stake. Do not prune rose plants in the fall. Wait until spring when covering is removed and then cut back to first bud beyond part which appears dead, or to shape the shrubs as desired.

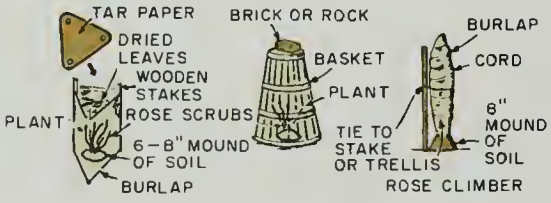
Some plants can suffer from too much winter protection. For example, just a light covering of leaves is better for iris, Shasta daisies, pinks, primulas, hollyhocks and foxgloves. Coal ashes are the ideal covering for delphiniums. Geraniums must be dug up, potted and placed in a cool part of the basement if they are to be held over for next year. Water them just enough to keep them alive. Geraniums can be used as winter house plants by cutting back. New growth will start off old stubs. New plants can be propagated by placing cut end of slips or cuttings in flower pots and covering with a glass tumbler to keep air moist and warm. After formation of roots, remove tumbler so plant can develop. If dewberries are not considered hardy in your locality, just loosen the ground on one side and throw a few shovelfuls of soil over the canes.

The fall of the year is the best time to start a compost pile for two reasons. First,

because it will enable you to get rid of all the vegetable-garden refuse, leaves, grass clippings, fallen fruit from trees, etc. after your fall clean-up campaign. Second, it will supply you with humus and plant food for next year's use. To make a compost pile quickly, set up a ring of wire fencing in the garden area. The size of the ring will depend upon the amount of material you have to compost. Dump leaves and garden refuse in the ring and tramp down until a four to six-inch layer is built up. Sprinkle a compost accelerator over the refuse and cover with a one inch layer of garden soil. Repeat this layering procedure until the ring is full or you run out of material. If manure is available from a local riding stable or farm, a bushel full will take the place of the compost accelerator between layers of leaves. Next spring remove the ring and work the compost into the garden when turning over the soil.

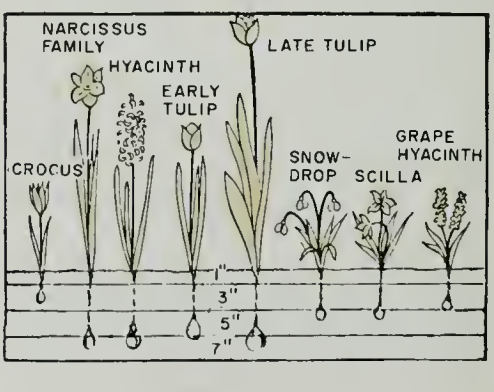
Little need be done in the way of winter protection for trees with the exception of wrapping the base of the trunk of young or newly planted trees with wire screening, tar paper or aluminum foil to prevent rabbits and mice from eating the young tender bark. Also make sure the lawn is free of leaves and does not go into the winter with any more than two inches of top growth.

Storage of bulbs and plants. Many bulbs, roots and corms are not hardy and must be dug up and stored indoors over the winter in a frost-free place. Remove the tops from canna roots, pack in boxes containing sand or peat moss and store at 36° F. Peruvian daffodils and fairy lilies must be dug (after frost has killed the tops) and stored at 40° temperature in boxes or bushel baskets containing sawdust, vermiculite or dampened peat moss. Montbretias are treated the same as Peruvian daffodils. Tops should be removed before storage. After frost has killed the tops of dahlias, cut them off to within six inches of the ground, dig up, dry thoroughly and store at 45 to 50° F. in boxes containing sawdust or dampened peat moss. Caladiums and callas need higher storage temperatures—around 50 to 60°.



Bulbs in flower pots that have been outdoors during the summer are laid on their sides for winter storage in a cool but frost-free place. Pigridia corms may be dug before frost and hung up tied in bunches by the foliage. After hanging for a month or until ripe, cut off the tops and store corms in a warm dry place in sand. Since tuberous rooted begonias are so tender, take them up after the first light frost and wash away all the soil. Then lay them out side by side and allow to cure for a week or so. After curing, remove the stems and sort tubers according to size before storing in flats or paper bags packed in dry sand or peat moss at 45 to 50° F. Lift gladiolus corms any time after the first frost but before the foliage dies down. Cut off the tops close to the corms and burn the tops. Dry the corms carefully for about a week on a window screen so that air can circulate around them and store in paper bags at a temperature of 40 to 50° F. To control thrips, dust corms with a 3 to 5% DDT dust.

Fall pruning. Pruning is necessary to



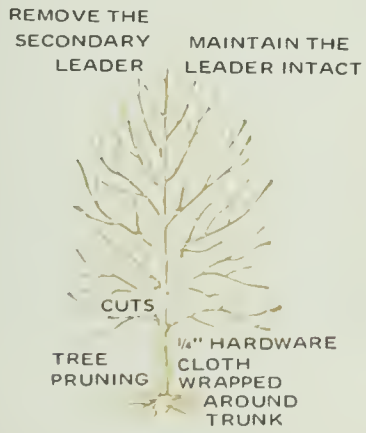
maintain a healthy balance between the plant top and its root system and also to improve the appearance and productivity of the plant. Keep cutting tools sharp to avoid bruising the plant stems. When using a single blade pruning shear, cut with the blade toward the growing plant. Any bruising of the stem will then occur on the part to be thrown away. Cut about ¼-inch above a vigorous bud and at a slight angle. Since new shoots have a tendency to develop in the direction in which they point, future growth of the plant can be shaped during the pruning process.

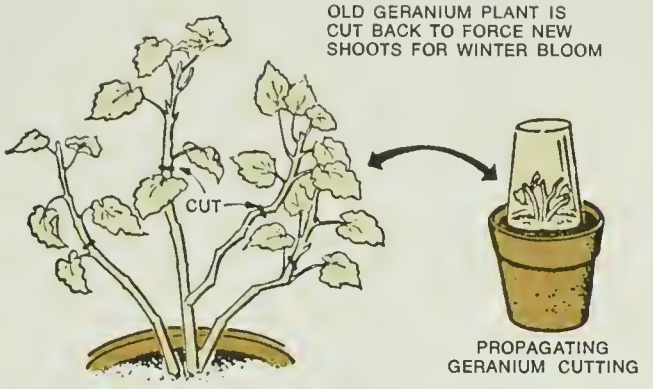
Grapevine pruning is done during the winter while the vines are dormant. It is a necessary task because no pruning eventually means no grapes. Cut back all the side shoots that grew this year to four buds. To stimulate fruit production on blackberries and raspberries (except the everbearing varieties), remove all canes that have fruited this year. Do not prune rose bushes until spring because open cuts allow frost to penetrate canes and stems too deeply.

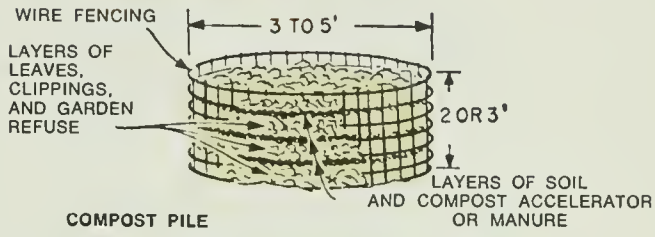
Shade trees should be pruned during dormancy in the fall of the year. Cut out all dead, diseased and damaged wood. If the tree has developed a secondary leader, remove it to maintain future balance and shape of tree. Cut off large branches with a saw following the steps shown in the drawing to avoid stripping the tree trunk bark. Coat all newly cut surfaces with a tree-wound paint. Also remove the weaker one of any two branches that are crossed so that their rubbing each other is causing bark wounds.

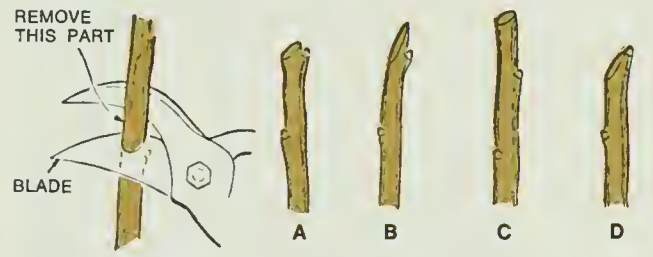
If special tree-branch bracing on valuable full-grown trees is needed, call in a trained arborist in order to avoid injury to the tree. M.A.H.

See also: GARDEN PLANNING; TOOLS, GARDEN.

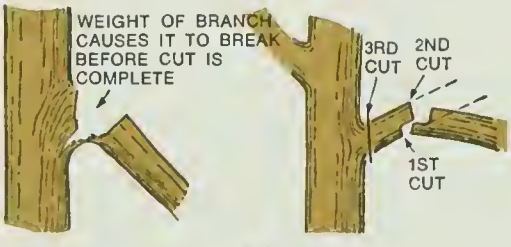





WIRE FENCING
3 TO 5'
LAYERS OF LEAVES, CLIPPINGS, AND GARDEN REFUSE
2 OR 3'
LAYERS OF SOIL AND COMPOST ACCELERATOR OR MANURE
COMPOST PILE



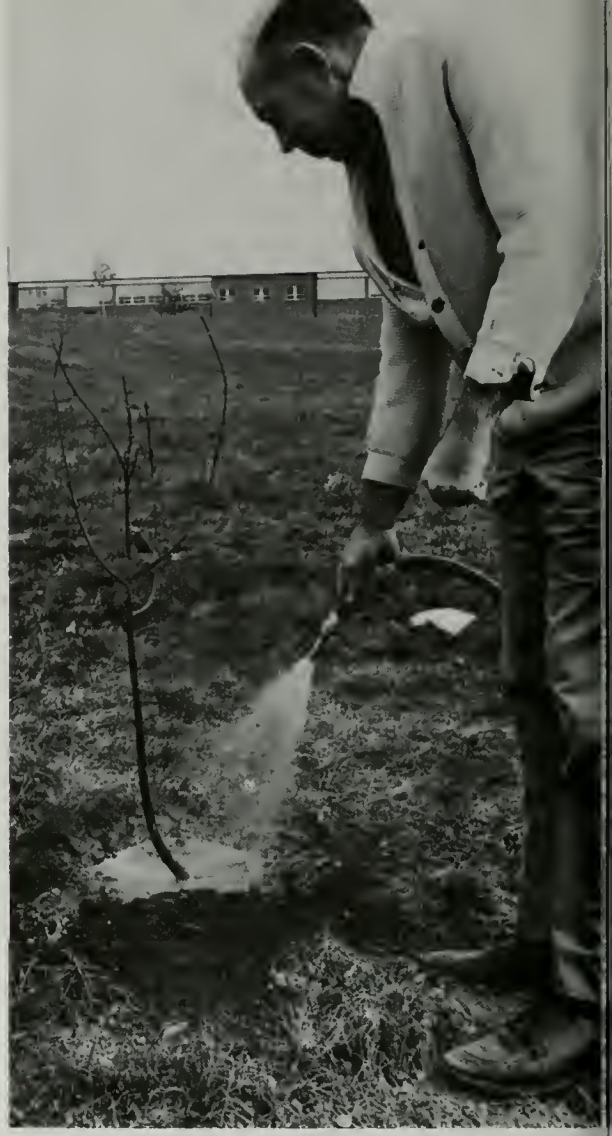
A. Correct: cut about ¼" above bud at a slight angle.
B. Incorrect: angle of cut too great, will dry out.
C. Incorrect: stub too long, will rot.
D. Incorrect: cut too close to bud, will cause bud to dry out and die.



METHOD OF CUTTING HEAVY BRANCH

How to Water Gardens, Lawns and Trees

Properly watered plants will have healthy, deep roots protected from heat and frost



MANY GARDENERS are surprised by a plant's nearly insatiable thirst, yet when they understand the way a flower lives the explanation is simple: water is one of the basic elements in plant life.

Although some plants absorb moisture through the leaves, most draw it from the soil through the smaller root hairs. Only a fraction of the moisture absorbed is retained. The greater amount works as a conveyor belt to carry nutrients, or acts as a stiffener to keep the plant turgid, that is rigid or erect. Much of this moisture is removed through the leaves in a process called transpiration. Transpiration prevents a dangerous rise in temperature within a leaf even in direct sunlight and prevents the plant issues from being killed. The amount of water required varies with the plant and the weather conditions. More water is required in summer than in winter.

The soil itself is a reservoir, a "water tank." It can hold just so much water, and no more, and its supply is constantly being withdrawn by the plant. When a soil is holding all the water possible it is said to be at "field capacity." Excess water, which drains away, is called "free water." The ability of a soil to deliver water to plants varies. Coarse-textured soils hold relatively little water, but deliver nearly all to the plants. Fine-textured soils hold larger amounts, but yield proportionately smaller quantities.

Watering basics. The successful gardener follows one rule: Water thoroughly but infrequently. Under-watering is particularly dangerous. Small amounts of water only dampen the soil drawing roots to the top where sun and heat can kill them.

The hair roots, which absorb moisture, grow where there is nutrition and water and, if both are present deep, the roots grow deep. But when either of the essentials are shallow, the roots rise. Therefore, a thoroughly watered garden has healthy deep roots which can best withstand sun, frost and wind.

It takes time to water thoroughly—time for the water to penetrate the ground inch by inch, layer by layer. In most soils it requires 12 to 30 minutes for water to penetrate to a one foot depth. Begin by establishing some kind of standard watering schedule. Place tin cans in areas beneath your sprinkler then turn the sprinkler on until the cans hold one inch of water. One inch of water will penetrate one foot of sandy soil, half a foot of loam or one-third of a foot (4 inches) of clay. You can calculate watering times from this schedule.

If you take the time to soak the soil in your garden to saturation, that is field capacity, your plants can live from one week to one month without additional watering. The period between waterings depends on the root depth and soil conditions.

Water systems. With large areas, try overhead or buried sprinklers. Finer sprays are best for shade-loving plants which prefer a slightly acid soil. For individual plants, try soakers or bubblers. For good penetration, fill a trench from an open hose, or use the special root-feeders discussed later, or sink a one-gallon tin can in the ground. Punch a number of holes in the side and bottom of the can then fill it with water. During the summer flush the foliage with water daily to remove dust. Clean drives and walkways to keep them cool and to increase the humidity in the air.

If you use nozzles, try the classic all-purpose type which offers adjustments from mist to a full stream for general use, but for container plants try a hand-controlled nozzle with a misting rose. The attachment breaks the stream into a gentle flow that cannot damage the soil. A fan-shaped nozzle offers a similar control and is ideal for gentle garden watering.

Basins. A water basin is an extremely effective method of watering trees and ornamental shrubs—simple, easy and inexpensive. Make a foot-wide trough around each plant at the drip line. Do not dig a trench (that could expose shallow roots) but create a dike on each side. The trough should be three to six inches deep for shrubs, 10 to 12 inches deep for trees and slightly larger than the plant itself. Fill the trough with water and allow it to soak into the soil at least twice.

Soakers. Years ago gardeners made soakers from lengths of burlap, but now you can buy canvas or plastic hose with holes—for less money than the cost of making them. Soakers are ideal for plants such as zinnias, hollyhocks, tomatoes, delphiniums and dahlias. Overhead watering can cause mildew but soaking does not.

Subsoil irrigation. Deep-rooted plants—trees are an example—often need water at the root zone. Professional gardeners once used sharpened pipe which could be punched into the ground then attached to a hose. It carried the water directly to the root zone. We will come to a ready-made counterpart later.

Overhead watering. The best way to water a large area evenly is with an overhead spray. In professional gardens, one can build an overhead system in the roof, but for most gardens a portable pipe works better. One of the easiest to make is a length of ¾- or 1-inch galvanized pipe bolted to a stand and fitted with a rotating sprinkler. If you take time to run the one-inch water test described earlier, you can accurately time the watering from an overhead system to water the exact depth the roots demand.

Permanent sprinklers. A buried sprinkling system is ideal for lawn care and several good systems are available. Among the best are the plastic systems which can be

assembled with very few tools. A system such as the one diagramed can be assembled for less than $100.

Water lawns as you would other garden plants—infrequently but thoroughly. The first sign that a lawn needs water is wilting, a loss of resilience in the blades. Grass that is dark gray-green or smokey is in need of water.

Watering trees. Most neglected of all are shade trees because lawns, walks and driveways rob them of food and water. Lack of air circulation in the soil is a contributing factor. Water, minerals and plant food must travel from the feeder roots to the main trunk and up to the foliage for healthy growth, and hard-packed subsoil disturbs the flow.

The leaves are the best starting point for checking on nutritional problems, since they are the first to reveal the effects. If they are discolored at the base or tip, a lack of balanced plant food is generally indicated. The condition can be corrected by a thorough feeding with a complete liquid plant food made available to the root zone.

Leaf scorch (uniform browning of leaves on a given branch) usually occurs when roots fail to supply sufficient water to compensate for evaporation losses. Leaves are most severely affected during periods of high temperatures, drying winds and prolonged drought.

Leaves mottled or yellowed with darker green veins indicate chlorosis (an iron deficiency). In acute stages, the whole leaf yellows and falls off, the plant stops growing and, if the condition is not corrected, the plant may die. The condition can be remedied with a root feeding of a plant food containing chelated iron. Since iron chelates remain fixed in the soil until used up, one or two treatments will usually produce the desired results.

The mere insertion of a dry fertilizer into the soil around the tree is no guarantee that the tree will benefit. Unless the plant food is placed in the immediate vicinity of the roots, much of the food is absorbed by the grass and surface soil particles; only a small portion of it gets to the roots.

A soil auger can be used and a liquid fertilizer can be poured into these holes. A long iron bar is also a handy tool for driving holes into ground around trees, but gardeners who wish to feed their trees with an apparatus similar to that used by professional tree men should try the Ross Root Feeder. A premeasured plant food cartridge is placed in the chamber at the top of the feeder, a garden hose is attached at one end and the pointed rod is inserted into the soil at the proper depth. When the water is turned on it dissolves the plant food and delivers the solution to the root area.

This method carries the additional advantages of aerating the subsoil, introducing oxygen, and guarantees the even distribution of plant food.

Evergreens are even more susceptible to dry, windy conditions than deciduous trees, and replacement of water in the soil should be made during such times—even better, regular root feedings.

All feeding of trees should be done in a ring around the outermost reaches of the branches and at intervals of about 30 inches. For trees with wide branch span, it is advisable to repeat this process in a ring halfway between the outer branches of the tree and the trunk.

A general rule is to "feed whenever a tree needs it." However, in cold weather areas, you should discontinue the feeding of fruit trees, roses and tender new plants six weeks before the first killing frost. After plants have become dormant, a final thorough root feeding will provide food for the winter as well as nourishment for use in early spring. An extra bonus is that trees well fed and soaked at the roots will probably show a brighter autumn leaf coloring

➤ *You can pick up a sprinkler of this type and move it without getting your clothes or shoes wet. It throws a fan-shaped spray forward.*

than those allowed to go into fall with inadequate moisture and food.

Most homeowners know that compacted soil is a lawn's worst enemy. Grass refuses to grow when the soil is too hard, but few people realize that hard soil can also have an effect on shade and ornamental trees. A tree develops symptoms so slowly that most go unnoticed, but growth slows and foliage becomes sparse. Unless corrective action is taken, the tree may die.

To understand the problem it is necessary to understand how a tree functions. Most of the needed oxygen, water and minerals are absorbed by the tiny, hairlike roots that project from a tree's absorption rootlets located in a circle under the outer drip branches. Water, containing dissolved minerals, is absorbed largely by osmosis (diffusion through the membranes of the roots). The sap travels through the trunk until it reaches the leaves where a part of the solution is transformed through photosynthesis into the cellulose material. The remaining moisture transpires through the pores. A tree may pump as much as 200 gallons of water a day!

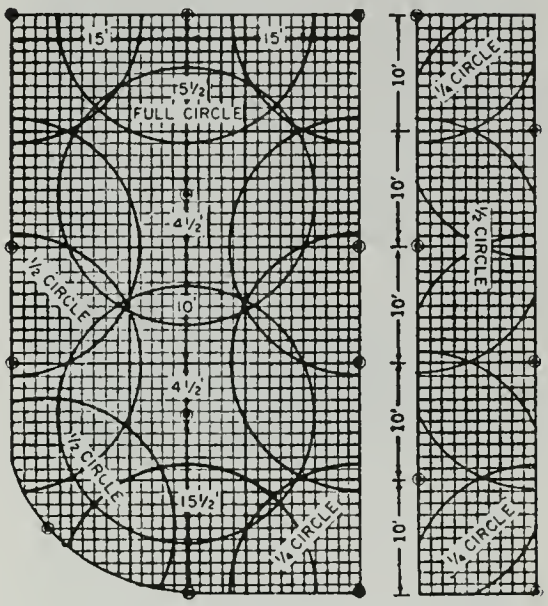
If the soil around the feeder roots becomes dryer than the body of the tree, the capillary action reverses itself. The water flows from the leaves, down the roots and into the soil again. Leaves wilt and growth stops. In order to keep a tree flourishing, it is necessary to have plenty of minerals and water in the soil around the roots. When the soil becomes hard-packed, rainwater runs off instead of soaking in deep enough to reach the roots. The soil around the roots must be kept loose enough so that the moisture can flow freely and so that the roots can develop and extend as the tree grows.

An easy way to correct a compacted soil condition is the previously mentioned Ross Root Feeder, an implement which connects to your garden hose. It has a transparent chamber into which plant food cartridges can be loaded and a perforated spike which is pushed into the ground to depths up to 27 inches. When the valve is opened water flows through the chamber, dissolving the plant food and carrying it through the spike directly to the feeder roots of the tree.

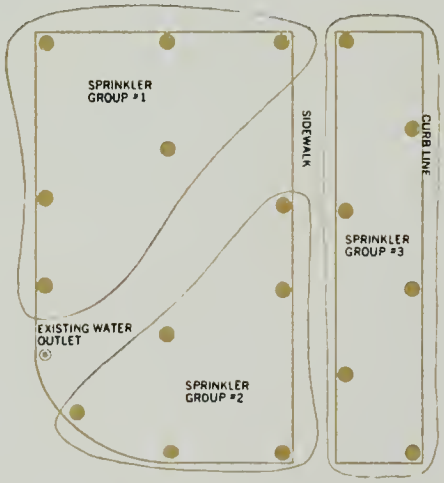
A recent test indicated that chemicals

1252

Installation of an underground sprinkler system can be made by the homeowner.

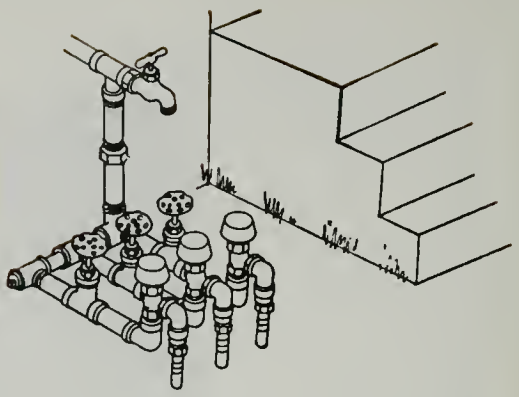


▲ *On graph paper, map yard, including water outlets. Position sprinklers and, with compass, scribe the overlapping spray patterns.*



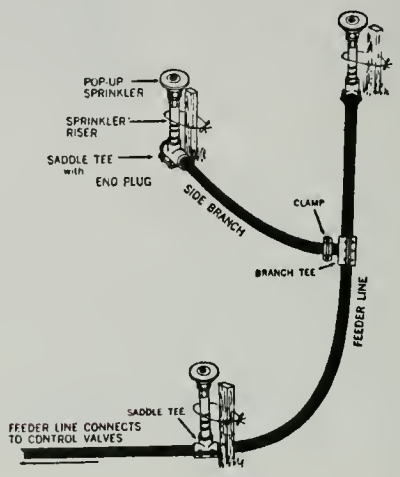
▲ *Group adjacent sprinkler heads—those to operate off single control valve. Pressure and outlet pipe size are determining factors.*

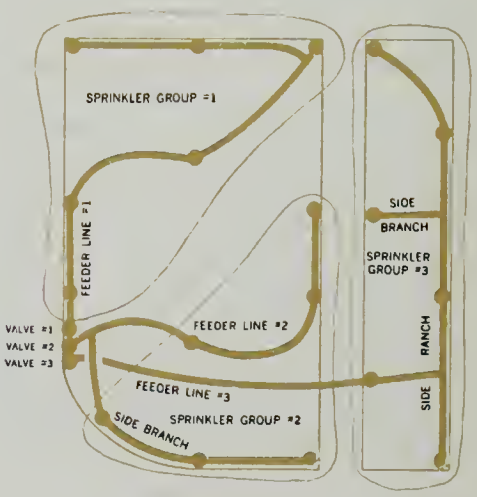
➤ *Draw in piping system that connects sprinkler groups to control valves. The number of groups tells how many valves you'll need.*

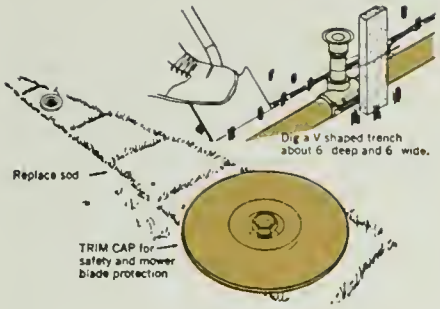


▲ *Position control valve on graph, as near existing outlet as possible (to cut materials cost) but considering convenience too.*

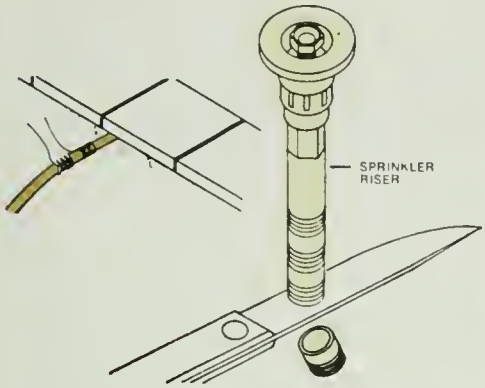
▼ *Now the groups of sprinklers are actually connected, staked, and the system tested.*





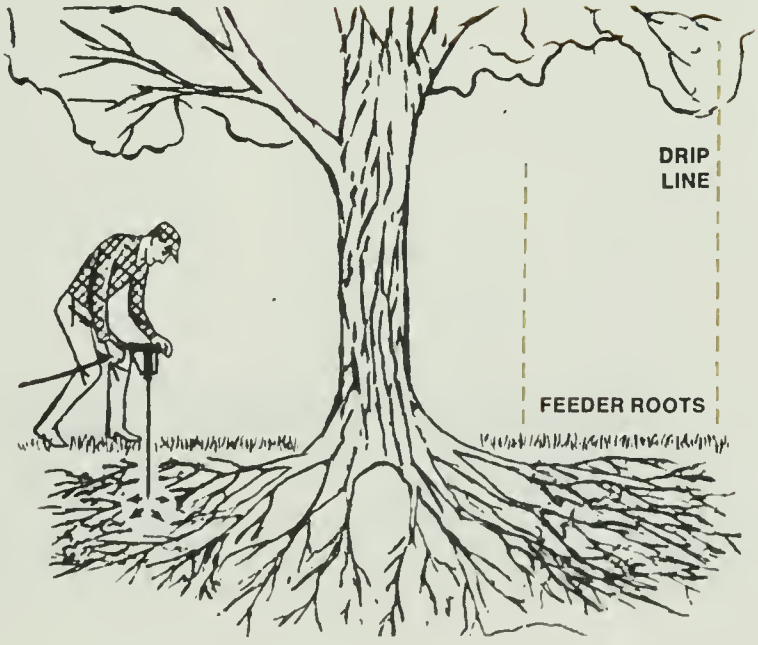


▲ *If test proves satisfactory, system is buried in 6-inch deep trenches. An optional cap, foreground, halts growth over the sprinkler.*



▲ *Pipe on hose-end makes route for system under walks. If trench is uneven, the sprinkler riser can be trimmed down with knile.*

▼ *The root feeder will penetrate mulch and deliver water, food and insecticide to roots.*



➤ *Tree's feeder roots extend from outside drip branches half the distance to the trunk. Sub-surface feeder is inserted full depth to feed at 6-ft. intervals around tree. For large trees, process is repeated in a ring half the distance to the trunk. To aerate hard-packed soil, open valve of device full force for first few minutes of feeding and watering your trees.*

fed to the roots in this manner had moved to the top of a 20-25 foot tree within one hour.

The root feeder is not only able to form a simple line connection to the roots, but dissolves any of about eight different fertilizer combinations with minimum effort. It cannot burn and no plant food or water is wasted by run off, or stolen by surrounding turf or by the micro-organisms near the surface of the soil.

As soon as the recommended amount of plant food has dissolved, open the shut-off valve all the way allowing the water to run full force to aerate and loosen the compacted subsoil and to allow the water and minerals to circulate freely.

Root feeding roses. In the spring, control your impatience for quick top growth of your roses and try a first root feeding with the high phosphate starter cartridge (9-46-15). Often a rosebush which looks badly damaged at the end of winter comes back and blooms as quickly as new bushes when fed with this cartridge.

Midsummer problems. Midsummer days are the greatest danger days for roses. You not only have to fight drought and burning winds, but your tendency towards neglect. Since you can root feed any time of the day or evening (no water touches foliage), reserve the cooler hours to revitalize your plants—especially when limp foliage and smaller blooms show symptoms of starvation.

Avoid dusting or spraying a dry plant. To protect plants from shock caused by using pesticides when plants are dry, do not apply any until after rainfall or root feeding.

How to Water Gardens, Lawns and Trees

The root feeder penetrates through mulch and replenishes food the decomposing bacteria have used up working on the mulch. Saturate the soil thoroughly, then allow a longer period of time between feedings than if the soil had been left unprotected by mulch.

Iron chlorosis. If you have fed your roses throughout the season with the Prize Rose cartridge, chances that this iron deficiency will develop are minimal. However, if you discover the leaves are becoming yellow, leaving only the veins green, your plant may be suffering from chlorosis. This condition can be caused by either a lack of iron in the soil or a lack of available iron locked up in a form that cannot be used by the plant. This can be corrected quickly by root feeding with the Ross Iron Deficiency cartridge. In a matter of days, leaves will take on color and vigorous new growth. Seldom are more than two feedings required for recovery.

Fall care. This is the "reap the profits time" for your roses. About six weeks before anticipated frost, taper off feedings to discourage new growth. When leaves have fallen, mound soil about six inches high around plants in cold areas; in mild areas, be sure the graft union is covered. Stretch climbing roses on ground and fasten down. Loosen roots on one side of tree roses and press them down into a prepared trench and cover. Just before ground freezes, feed all plants thoroughly so the plant food will be in place for early spring and the roots will enter winter with ample moisture. Do not mulch until ground is frozen.

See also: FERTILIZERS; GARDEN PLANNING; LAWN; TREES.

WATERING FREQUENCY IN DAYS

Root depth	Sandy soil	Loam	Clay soil
Shallow root depth	3-6 days	6-10 days	9-13 days
Medium root depth	6-9 days	9-14 days	14-19 days
Deep root system	14-21 days	15-30 days	more than one month

Choosing Garden Favorites

Make your summer garden plans by using this guide to popular plants, from alyssum to zinnia

YOU MIGHT THINK it is easy to plan a new garden. But with more than 2000 species of flowers to choose from, and more than one hundred introductions yearly, the problem is numbers. How do you choose the best from so vast a field?

To help, here are some of the most popular flowers for your consideration. Under each species are included trusted favorites as well as some of the most interesting new variations.

Alyssum. An annual, sweet alyssum (*Lobularia*) grows easily, generally less than six weeks from seed to bloom. Try it in large beds beside lawns and near your home. A hardy plant, it does well in regular soils requiring minimal watering and care. Broadcast the seed directly to the beds or start in flats.

Try proven favorites—Royal Carpet, Carpet of Snow, and Little Gem, a pure white four-inch version.

Aster. If you like cut flowers, make the perennial aster (*Callistephus*) a standby. One- to three-foot tall plants yield two and three inch blooms in a variety of colors.

The preparation of soil is important: 30 to 60 days before planting, work the ground deeply, adding generous quantities of fertilizer. Plant seed directly in the prepared bed. If the frost-free season is short—less than five months—start plants indoors in flats. Transplant after eight weeks.

Favorites include Michaelmas Daisy (a hardy version), New England and New York Asters (3- to 5-foot) and the Bushy Aster which includes the lovely Pacific Amaranth. For a shorter variety try the Alpine Daisy or Rock Aster.

Bachelor button. Sometimes called cornflower, bachelor buttons (*Centaurea*) are offered in almost every color. They are most common in rose, pink, wine and white. They are hardy plants, and do best when started in the fall from seed. In many areas, they can be planted in September and October before the cold weather begins. Be sure beds are in an open area since *Cen-*

garden tools: see tools, garden

taureas like plenty of sun. Bachelor buttons dislike rich soil and do better when neither over-fed nor over-watered. Heavy feeding tends to reduce flowering.

Two of the best known species are *Centaurea Cyanus,* the cornflower or bachelor button and *C. maschata* or Sweet Sultan. Most of the larger seed houses offer several varieties.

Calliopsis. An annual, *coreopsis,* this summer-blooming flower is one of the easiest of all plants to grow. Some varieties are short and others are tall. The taller species reach three feet and make excellent background flowers. Their daisy-like blooms are most often yellow or reddish-brown.

Candytuft. A cool-season annual, candytuft (*Iberis*) will flower in winter or early spring from seed planted the prior fall. Commonly has lilac, pink, rose, salmon, and white blooms. A long-lasting cut flower, it is often grown commercially. Dwarf versions are ideal for window boxes, pots and edging and make excellent bedding plants when you choose solid colors.

Try Globe Candytuft (*Iberis umbellata*) when you need bushy plants. The 12- to 16-inch plants are covered with rich blooms in early summer. Hyacinth-flowered Candytuft (*I. amara*) has smaller blooms and is sometimes called Rocket Candytuft. It commonly has white flowers with hyacinth-like trusses.

Cineraria. Many gardeners list cineraria (*Senecio*) among the most beautiful of winter and spring-flowering plants. It prefers shade and rewards gardeners with daisy-like flowers. Cineraria needs plenty of water and the leaves should be moistened on warmer days. Essentially a perennial yet many variations are grown as annuals and many gardeners buy new plants yearly.

Choose both the small version, Cineraria Stella or Star Cineraria and the larger C. multiflora nana. Seeds are small and difficult to handle and most gardeners buy the

▲ *If you want cut flowers, plant asters in a variety of colors. Some grow three feet tall.*

➤ *Semi-dwarf cerise asters.*

plants in flats of 10 to 20. Set in shaded areas in a moist, well-drained soil.

Coleus. Another perennial generally grown as a bedding annual but also well-known as a house plant. Most gardeners know its serrated, richly-colored leaf. The plants prefer strong yet indirect light with plenty of water and nutrition. With care, coleus can reach heights of three or four feet with six inch leaves. When grown in sun, plants are smaller and leaves less brilliantly colored.

Most gardeners grow coleus from seed or cuttings. For the best germination, keep soil temperatures between 70 and 75 degrees. Use coleus as a background in garden arrangements.

Daffodils. One of the most popular spring bulbs, daffodils (Narcissus) bloom year after year, multiplying readily in nearly any garden. Most nurseries offer a substantial selection and specialists may offer several hundred varieties.

There are several categories to choose from: large-cupped varieties (as Carlton, Francisca Drake, Fortune, Tunis and Dick Wellband), small-cupped types (as Hades, Hera and Diana Kasner), Trumpet (Dawson City and Golden Harvest), Doubles (Texas and Twink), and many more.

Plant daffodils at varying times in the spring to guarantee a range of blooms. Plant early-blooming types to the rear of a bed and later-blooming ones forward. Be sure there is plenty of sun (although a few late-blooming varieties do best in filtered light). Bulbs are generally planted at a depth which is equal to 2½ times the size of the bulb.

The American Daffodil Society includes more than 100 moderately-priced varieties in a list that includes Trumpets, Doubles, Medium and Small Cups and others.

Dahlias. Few plants can match dahlia for a range of mid-summer and through fall

▲ *Marigolds, like these Empresses, grow readily from seed and are ideal for edge, full beds and as cut flowers.*

◀ *A basket of mixed-color Totem Pole asters.*

color. In those months, the plants offer a variety of colors and forms that resemble chrysanthemums, carnations, marigolds, and even zinnias.

Plant bulbs late when the soil is warm. Be sure the soil is well-spaded, composted and fertilized. Dahlias need a rich, warm soil to develop good color and size. Water as the bulbs are planted but not again until the growth tops the soil, about 30 days from planting. Once the growth surfaces, water regularly in accordance with leaf size and soil type.

If you like cut flowers, don't pick blooms during mid-day or immediately after watering. Choose only fully-developed, wide-open blooms, since buds will not develop after they are cut.

Consider the recent dwarf dahlias as bedding plants. Some, about 18 inches tall, are covered with blooms that last through to the first frost. Double and semi-doubles are good choices. In colder areas start dwaf seeds indoors, but in warmer areas sow directly in the ground.

Foxglove. Sometimes a perennial and sometimes a biennial, foxglove (*Digitalis*) grows well from seed started early the previous year. With four- to eight-foot stalks, the plant features "woolly" leaves and clusters of spike-like blooms. The plants prefer shade and protection from wind.

Try the hybirds. Two good versions are Shirley and Excelsior. Shirley has large, bellshaped blooms in colors from deep rose to soft pink. Excelsior tends more toward white, cream and yellow, but can be found in purple and rose.

Godetia. Sometimes called Farewell-to-Spring, this cool-weather annual blooms in early summer. Each year new colors and improved forms are added and the satiny texture of the flowers is appealing. Godetia are long-lasting as cut flowers. They have been seen in New England, north-central and even mountain states.

Use them as fillers in perennial borders since their height, less than two feet, is ideal for intermediate positions. Most species prefer a sunny, or partially-sunny, location.

Petunias, such as these Royalties, belong to the nightshade family and are easy to grow.

Man-on-the-Moon marigolds.

Plant them close: Godetia like crowding. Three popular varieties are Kelvedon Glory (salmon to orange in color), Sybil Sherwood (salmon to pink, edged with white) and White Swan (all white).

Hyacinth. The versatile hyacinth (*Hyacinthus*) blooms naturally in March and April but can be forced to bloom in January in pots. The common variety (*orientalis*) grows 9 to 19 inches while a Roman Hyacinth is smaller, seldom reaching more than one foot in height.

Plant in strong sun, although it can tolerate light shade. Set bulbs during the fall in well-spaded, lightly-fertilized soil, five to seven inches apart. If gophers are a problem, plant in wire baskets. In pots, the tip of the bulb should protrude above the soil.

Impatiens. Three species are included, balsam, an annual (*Impatiens balsamina*), and the more vigourous and taller *I. holstii* and *I. sultanii.* Both are perennials but sometimes grown as annuals.

Balsam is not as popular as it once was. You can find a range of colors in both local and mail order nurseries. A sturdy plant, it normally grows one to two feet tall with thick clusters of double flowers. *I. holstii* and *I. sultanii* grow to three feet with larger flowers and leaves. Both prefer shade. Seeds should be started indoors 2½ to 3 months prior to transplanting.

Larkspur. A beautiful plant with tall, full spikes and a variety of colors from white through violet. They make excellent background plants in almost any bedding situation and can be used alone in front of fences and patios.

Larkspur (*Delphinium*) are annuals and do best when grown under cool conditions. Seeds sown in the fall (in the ground or in flats) will produce a wealth of spring flowers. Seeds sown in the early spring can yield flowers until the hot weather. Because of an inadequate root system, the spurs may require support. Colors range from lavender and dark blue to cerise and pink.

▲ *These Red Gold roses are among the many types and varieties available to the gardener. Roses are truly a garden favorite.*

▼ *Old Timer roses.*

Lilies. Advances in hybrid lily development now offer crosses that grow well in nearly every climate. With new forms and colors, today's varieties include some of the

most beautiful and hardy plants you can buy.

Transplant most bulbs in the fall (exceptions include Madonna lilies which should be planted in late summer). Plant new bulbs as quickly as possible after arrival. Those which sit above ground in the fall may lose vitality. Plant them in full or partially filtered sun. The ideal soil is rich, well-drained and moist, neutral or slightly acid. Many gardeners place bulbs on top of moist soils adding six to eight inches of prepared mix over them. The most common mixture includes sand, manure and leaf mold.

June blooming plants include Rainbow hybrids. Golden Chalice and the white flowering sport, Martagon Album. For plants that bloom in July, try Mid-century hybrids such as Enchantment, Harlequin and Pagoda and Bellingham hybirds developed for the Pacific Coast. Regal and Olympic hybrids are also good. Fiesta hybrids grow on stems that may reach five feet. For late-blooming plants try such plants as Aurelian hybrids: Sunburst, Golden Clarion and Heart's Desire.

Marigold. The gardener's mainstay, marigolds (*Dimorphetheca*) are popular with novice and experienced gardeners alike. Beginners like them because they grow readily from seed and experienced gardeners like them because they are offered in sizes from 6 to 36 inches. Marigolds are ideal for edging and full beds and are excellent as cut flowers.

Spread seeds in a sunny location. When the soil is warm, they will germinate in a week or less. If you prefer, you can start with nursery plants. Smaller varieties should be started about six inches apart and larger ones 12 to 18 inches apart. Water often, but try to keep the leaves dry. Frequent overhead watering can cause plants to bend, sag and break. African Marigolds should be pinched back when 8 to 10 inches to keep them from becoming leggy.

Among the taller versions some favorites are African, a late-blooming version that may reach three feet, and Crackerjack, a mid-season blooming species with double flowers. For dwarf types choose from French and African types. The French Petites are an unusual, lovely double that grows to less than one foot. Many gardeners prefer Petites as edgings. African dwarfs are slightly larger and have a large variety of bright colors.

Petunias. Not long ago the petunia was the "ugly duckling" of the garden, but now it is one of the best known annuals with a surprising range of hybirds. It is a member of the nightshade or potato family and a native of Argentina.

Petunias are surprisingly easy to grow from seed, but the seeds are tiny and must be mixed with sand to guarantee even distribution. Germination requires less than two weeks. In milder areas, seeds can be sown outdoors. In colder areas, sow in flats about two months before the plants are to be set out. Germination generally requires less than two weeks.

Petunias can be tricky in the early stages and you may prefer young nursery plants. Choose sturdy seedlings. Avoid leggy or woody plants. Plant about 12 to 18 inches apart in full sun (although partial shade is acceptable).

Roses. The rose stands above all other flowers. No other plant has been a garden favorite for so long a time, and no other plant offers such magnificent blooms from spring to fall or such variety in form and fragrance.

Traditional types include tea roses, hybrid perpetuals and Noisettes and newer types include hybrid teas, Floribundas, Grandifloras and Polyanthas. Most will grow almost anywhere you give them a home. The ideal rose garden is in an area with heat for summer growth, enough humidity to prevent petal burn, and winters cool enough for dormancy. Yet if you live

in an area with less than ideal conditions, your local nurseryman can choose hardy species for your area.

Roses are graded in three categories: 1, 1½ and 2. No. 1 is the best: plants with three or more strong canes starting no more than three inches above the bud union. Second grade is No. 1½. These plants will have two or more canes at least 15 inches long. The poorest grade is 2 with two or more canes about one foot long. If you want the best plants, insist that you get grades No. 1 and 1½.

The American Rose Society ratings are compiled yearly from reports from hundreds of members. A rating of 10 indicates a perfect rose and 6 to 6.9 is fair. The All-America Rose Selection (AARS) is chosen by a non-profit organization set up to test and recommend new introductions.

Ranunculus. Growing ranunculus is easy: Plant the bulbs in the fall, water in winter, then enjoy magnificent blooms for a period of four to six weeks in March and April. Nothing in the gardening world is as easy to grow.

Ranunculus grow about 18 to 24 inches tall. Ideal when you plant them with anemone in a bed or border. The anemones should be in front and the ranunculus in back. While ranunculus come in a full spectrum of colors, ranging from the reds, roses and pinks all the way through the oranges, yellows and whites, they do not produce any flowers in the blue or violet shades, but anemones are offered in beautiful rich blue and violet shades as well as in reds, pinks and white. The two complement each other.

Through years of hybridizing, it is now possible to obtain bulbs in individual and mixed colors. Among the favorites are Gold Ranunculus and White Ranunculus.

Ranunculus is not winter hardy and cannot be planted in the fall in climates with freezing temperatures.

The world's largest commercial planting of Ranunculus and Anemones is found in Southern California at the famous Tecolote Ranch near Oceanside, California. During March and April motorists on the Pacific Coast Highway are thrilled by the wave upon wave of exciting color that meets the eye when fields are in full bloom. The Tecolote strain of ranunculus and anemones is now so famous that millions of bulbs are exported to New Zealand, France, Italy and South Africa.

Twilight roses.

Tulip. The tulip is one of the finest garden flowers and, if you choose variations carefully, you can have blooms from spring through mid-summer. The flowers date back to the 17th century and perhaps the most noticeable difference between tulips then and now is color. Earlier plants had flatter blooms with softer, pastel shades.

Plant the bulbs in full sun, except in areas where the early summer sun is exceptionally warm. Bulbs should be set two times as

deep as the width of the bulb and about six inches apart. They are best planted in September and October. In warm areas they can be planted as late as November. If gophers are a problem, use wire baskets.

For early tulips the favorites include Keiserkroon, Single Early and General De Wet. Colors range from bright yellow through orange and scarlet. For mid-season blooms, Mendel, Krelage's Triumph, Orange Wonder and Triumph are suggested. All will bloom in May. For later blooms, try Cottage, Darwins, and Parrots.

Also popular are the very early flowering Tulipa Kaufmanniana in the delicate colors of the true Kaufmanniana species and Gaiety as well as the bolder coloring of Stresa and Alfred Cortot.

Parrot tulips, immense flowers with deeply cut petal edges, are generally considered later flowering than other classes of tulips.

A very wide assortment of Species tulips is offered, many producing numerous flowers on a single stem. Their bright, gay colors frequently accented with brilliant markings make the Species tulips particularly desirable for intimate groupings in a border or rock garden where their early flowering qualities are especially appreciated. Offers a brilliant display of scarlet.

Zinnias. For many reasons, zinnias are still the most popular of all annuals. There are so many varieties you could plant an entire garden with them without monotony. Try tall plants for background, dwarf varieties for edging and colors ranging from white through the scarlet. Anyway you consider them, zinnias are ideal for potting, beds, borders and cuttings. Few other plants are so versatile.

The flowers grow quickly and easily from seed, indoors or out. Plant them in well-spaded, well-drained beds in full sun. Set seeds four to six inches apart, ⅛- to ¼-inch below the surface. Seeds will germinate within a week and plants will grow best if you avoid over-watering. When stalks reach 5 to 6 inches, thin out the plants to 12 to 14 inches apart.

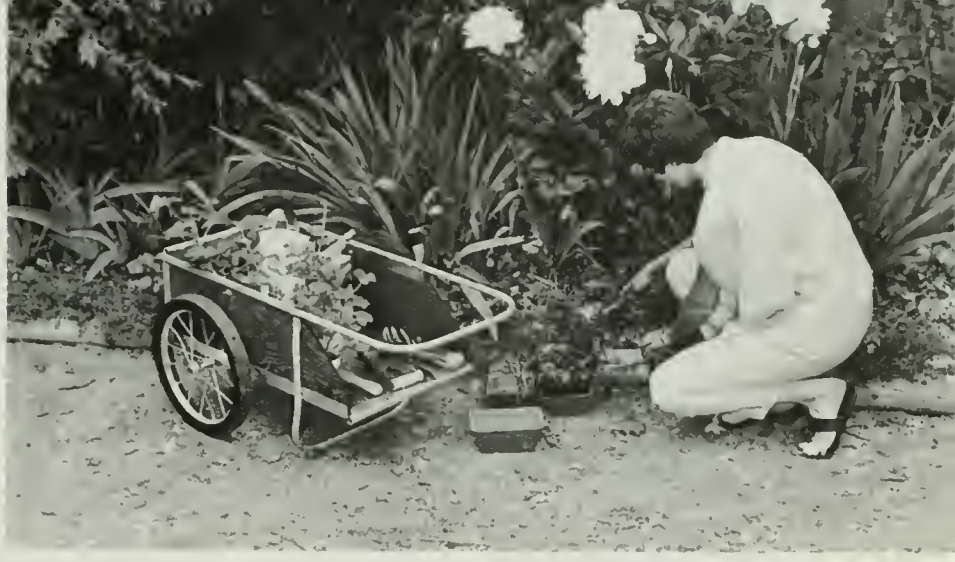
Favorite varieties: Cupid, a compact, foot-tall version with small double flowers and ideal for edgings; Cut-and-come again, also called Pumila, taller species (to 24 inches) with long stems and beautiful blooms—ideal for cuttings. Giant Double, to 3½ feet with large double blooms. Enchantress and Isabellina have pink and cream flowers. Cactus-flowered types offer growth to three feet with loose, shaggy flowers. For a variation in colors try Cherry Time, Lilac Time and Trail Blazer.

See also: FLOWERING BULBS; GARDENING.

Most popular garden annuals are zinnias. Shown here is an Emperor variety.

WHERE TO FIND IT

For list of daffodils and information on sources, write to the American Daffodil Society, 89 Chichester Road, New Canaan, Conn. 06840.



High maintenance growing areas should be designed to match the gardener's enthusiasm and available time. Wide walks let you focus on slim borders.

How to Make a Home Landscaping Plan

Save time, money and headaches by studying your family's needs and a few planting basics before you start landscaping your property

PLANNING IS THE FIRST JOB of the professional landscape designer. As a do-it-yourself landscaper, it should be your first concern, too. Before you turn any ground, turn your mind to the three basics that should guide all your primary planting decisions: your family, your homesite, and the "mini-ecosystem" that governs your land.

How to analyze your family. As any professional will tell you, a solid landscaping analysis starts not with the plot but with the characters: your family. And as the professional sees them, the people you live with are an assortment of recreational "units"—each unit consisting of one or more individuals with similar or identical needs.

Suppose, for instance, that you have two children, 9 and 11 years old. If both of the children are boys, they undoubtedly play together now, and probably will for years to come; therefore, the two of them are a single unit. But if the 9-year-old is a boy and the 11-year-old is a girl, their interests have already started to diverge, and they have nowhere to go except farther apart; so they're two units. As the professional sees it, children separated by more than three or four years of age belong in separate units, and so do boys and girls of almost any age.

Your own children may divide out into one, two, or three units, maybe more. Add one more unit for the adults in the family, and tally the total. In a moment you'll see how this breakdown is used in laying out a landscape plan.

But there are a few other family-type questions to consider first:

Do you generally entertain adults? children? mixed-age groups? small groups? big groups? The answers will help you decide how much space should be allotted to each of your family units.

Will the outdoor area have the services of an enthusiastic resident putterer? If not

(if both adults work, for example), planning should be aimed at minimum maintenance, with easy-to-care-for greenery, plenty of patio and pavement.

Do you see outdoor living as primarily a relief from your job? If so, plan for plenty of built-in contrast: space for active games like ping-pong or badminton if your work is sedentary; a sundeck and lounges if you work with your muscles all week; a vegetable patch and flower beds if you really enjoy gardening as a refreshing relief from working with machines or people.

Or will your outdoor time augment your job? If so, keep in mind that a patio and garden, pre-planned for business entertaining, can be a bigger asset than a case of bonded Scotch.

How long are your vacations, and where do you spend them? If you get three or four weeks all at once and spend them all away from home, better plan a landscape that hits its blooming peak when you're there to enjoy it, and requires minimum summer maintenance.

How to analyze the site. The process of tailoring plot to characters is mainly a matter of logic. To get the feel of it, consider first how it applies in the case of Mr. and Mrs. Jones, who just bought a typical development house and lot, and now face the problem of landscaping it from scratch.

The Joneses have three children: a son, 8; two daughters, 2 and 4. Mrs. Jones is home all the time, and although she likes flowers and gracious living, she dislikes heavy yard work. Both adults enjoy active exercise, but they can't afford a swimming pool. They generally entertain small-to-middling adult groups, but occasionally they have big family parties with lots of adults and children.

Naturally, there's no one right answer for their needs, but the accompanying sketch shows a layout that would meet them very comfortably. It also suggests some points that are sure to apply in your own case. For example: this family breaks down into three separate "units" (one each for the adults, the little girls, and the boy), and that each unit has a more-or-less separate recreation area.

The pre-schoolers' play area is located where supervision is easiest: here and in most homes, in view of the kitchen window.

Adult entertainment almost always in-

Family needs and lifestyle determine the layout of a garden. This compact growing area and plenty of pavement leave time and space for entertainment and family fun.

This patio-pool area eliminates litter-making deciduous plants and instead uses evergreens and tall perennials for screening and keeping clean-up to a minimum.

cludes food and drinks, and adult parties are smoothest and most flexible when they can expand or drift indoors. So the best location for the adults' outdoor area is one that has easy access to both the kitchen and the living/dining area.

The natural spot for an older child's play area is often near the garage. With the arrangement shown in the sketch, the 8-year-old can grow into the adults' game area, if he hasn't already. And maybe later, part of the garage will be converted into a teen-age-type recreation room, first for his use, later for the girls'.

It's unrealistic to design your maximum (and occasional) entertainment load, but the hard-surface game court (for ping-pong, shuffleboard, etc.) allows plenty of extra space for big mixed-age parties and also fills the Jones' yen for active exercise.

Note that the planting shown here is purely functional in terms of both the site and the Jones' lifestyle. Specifically:

Most of the unpaved area is planted in low-maintenance ground cover. Depending on the mini-ecology (see below), taste, and use requirements, it could be any of a wide variety of neat, easy plants, alone or in combination: ivy or creeping juniper, say, where there's no likelihood of foot traffic; Irish moss or zoysia grass where there is.

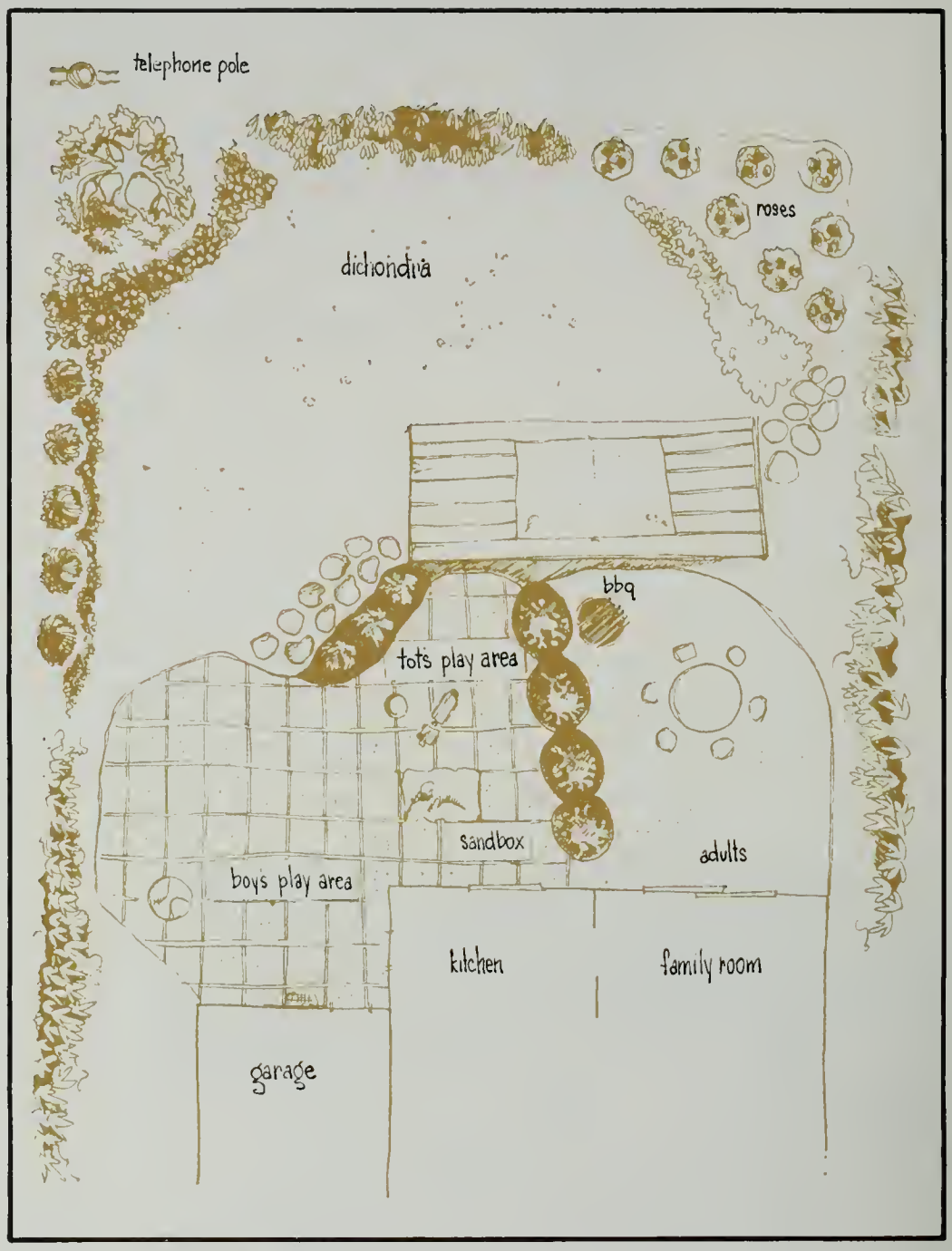
Shrubs are used functionally, for screening, separating and sound buffering.

The only area that needs more-than-minimum care is the compact rose garden at the rear. Note that it's located for easy visibility from the house and patio, so there's maximum visual appeal with minimum energy requirement, as per Mrs. Jones' inclinations. (Contrary to the common myth, rose bushes are hardy, not delicate. With loving care, they're spectacular; with haphazard care, they're merely beautiful.) Naturally, if the Joneses decide later that they actually enjoy gardening, they can easily replace some of the ground-covered areas with flower beds, borders, vegetables, or whatever.

So much for the Joneses. Next on the agenda: applying a similar process of analysis to your own plot.

Start by making a sketch of your own property on a large sheet of paper. Scaling as accurately as you can, draw in the unchangeable specifications and structures: the fences (or lot lines, if fencing isn't in yet), the garage and the house, plus any outdoor paving or decking that's already in and immovable. Also draw in the floor-plan layout at the rear of the house: room arrangement, windows, and back-door location.

Now, keeping in mind the number of "units" in your family, plus the lifestyle inclinations shown by your family analysis, sketch in patio-play areas that should work well for you. Even if you're working with



Making a sketch of your property helps you plan family garden needs. This layout allows recreation areas for adults and both younger and older children. Shrubs, trees and ground cover add privacy and separation; the roses lend a decorative focus.

a pre-built patio, the sketch will help you make important decisions: like, where each "unit's" equipment should go (lounge chairs vs. basketball hoop, for instance); and how you can expand or modify the existing setup. One example: an area "spared out" from the concrete pavement and used as a flower bed by the previous owners can easily be transformed into a sandbox for your pre-schoolers; when the children get older, it can be turned into a flower bed again. Either way—whether you're starting from scratch or working with an existing layout—don't plan for total permanence. Since change is inevitable, try to focus on ideas that have built-in versatility.

With the patio-play areas tentatively worked out, it's time to look at the lay of the lot itself.

If your property has a good view, you'll naturally want to keep the outlook as open as possible. But there will almost certainly be portions you'll want to screen: the service and utility areas, the neighbors' backyards, perhaps a street or a telephone pole.

Mark the points to be screened on your plot plan—and do it carefully, because these points are your guide to much of your basic planting. A few examples:

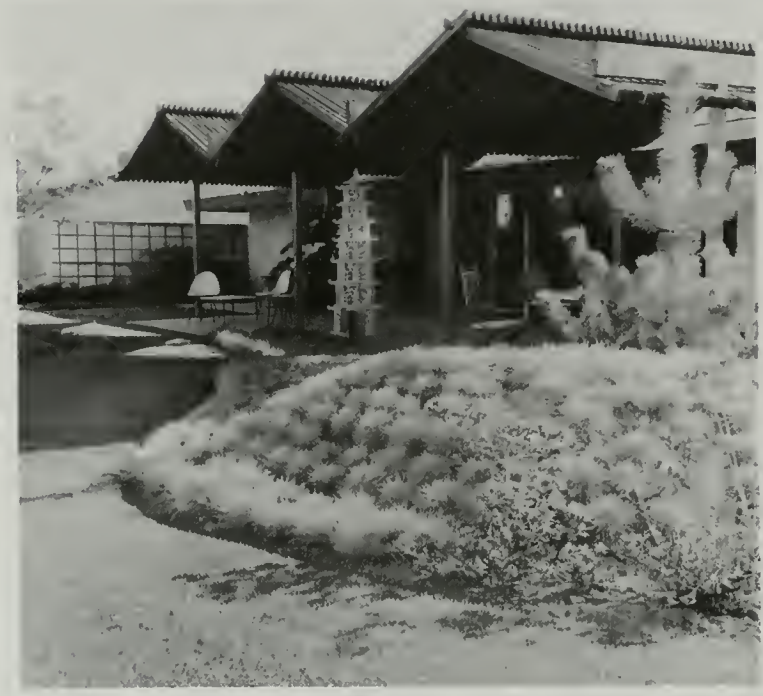
Close neighbors call for solid and fairly high screening: high, thick shrubbery, a concrete-block fence softened with ivy, redwood grapestake with vines, etc.

A telephone pole needs a separate high screen: a fairly mature tree, if you can afford one; if not, maybe an "instant tree" —that is, a high trellis covered with fast-growing vines.

A good rear view can be saved by putting thick, broad-leafed plants a little in front of the rear fence. They'll obscure the fence, shadow it, and make it virtually dis-

Both shrubs and fences can combine to provide screening; the addition of an oleander doubles the height of the wall.

Fences are not only heightened, but are also lengthened by plants. Here, shrubs take over after the brick wall quits.



Standard backyard lawns can be varied by the addition of a man-made hillock planted with a gray-green tufted ground cover requiring minimum maintenance.

An irregular terrain is given the split-level treatment. Weathered railroad ties make unique steps; border flowers will mass as they mature.

Knowing about plant growth behavior can save you money and effort. This ivy is already climbing the wall and may even crowd out other plants before long.

appear—leaving a deceptively "open" view of the mountains, fields, or water beyond.

Turning in on the ecosystem. Everyone talks about ecology, but hardly anyone looks for it in his own backyard—which is one reason that many gardeners spend a lot more time sowing than reaping.

Actually, your own property is just like the big world outside: its ecosystem is a matter of balance and interaction that involves plants, people, climate, and the use of the land. Fight the system, and you've got problems. Work within it, and you get the best results with the least effort.

Specifically, here are some of the factors to mull:

Where's the sun? Surprisingly, many homeowners don't know for sure whether their gardens face east or north, south or west. If you're one of them, get a compass and find out; then note N, S, W and E on the appropriate sides of your home-landscape sketch, so you can see exactly what sections will be most affected by the hot, long path of the summer sun and plant accordingly. If the patio-play area has full western exposure, for example, plants that will give it at least partial afternoon shading are as necessary and "primary" as the plants that provide privacy screening.

In the garden itself, a western exposure can be a boon in some climates: where summers are short and/or damp, it means quicker growth and fuller bloom without big watering problems. Not so, though, in hot, dry areas, where even "sun-loving" plants usually do best (with less watering) when you shield them with shrubs, a tree, or fencing that provides at least some later-afternoon shade.

Another point: Many, many flowers grow with their "faces" turned in the direc-

Specific plants need particular soil. This eight-foot camelia grows well in drop-leaf soil that is too acid for other shrubs.

tion of the strongest sunlight. If you want your flowers to produce their maximum visual impact for a specific viewing area (like the patio, say, or a living room window), keep sight-lines and sun direction in mind when you locate your flower beds.

How does the wind blow? Not just the prevailing wind (which tends to be pretty mild in most areas, or people wouldn't live there), but also the occasional Big Wind. In Southern California, for example, the usual wind is a light breeze from the west, but the Big Wind is the hot and powerful Santa Ana that sweeps down from the northeast; foresighted gardeners prepare for it by plugging a northeast exposure with windbreaks. If you're a newcomer to your own area, ask around about local winds, and plan accordingly.

Wind direction should also be considered when you plant deciduous trees and other potential litter-makers, especially the ones near patio-play areas. And if you plan to install a sprinkler system, keep in mind that the usual "perimeter" layout (which has lines of in-facing sprinklers bordering all four sides of the lawn or garden) can be pretty inefficient when it's windy. In an area that tends to be breezy during the prime times for watering (early morning and late afternoon) you'll get better coverage with lower water bills with a layout of parallel lines in which all the jets spray in a single direction—the same direction as the prevailing wind.

How's the soil? The ideal soil for gardening is a dark, crumbly loam that's loose enough to hold moisture, coarse enough to drain it perfectly, and rich in nutrents. Chances are that's nothing at all like the soil in your garden.

Actually, most soil *isn't* ideal: it's too acid or too alkaline, too sandy or too clayey. Or worst of all, it's the horror known as shallow-soil hardpan—a condition that most often comes about when builders level the land, spread excavated subsoil over the surface, compact it by running heavy trucks over it, and then conceal (but don't correct) the whole infertile and unnatural mess by covering it with a thin layer of loose and healthy-looking topsoil.

If you're stuck with hardpan, your gardening options are pretty narrow. You can a) settle for potted plants and Astroturf, or b) correct the soil—either by chemical amendment (see Soil Chart) or by organic techniques.

But with other kinds of imperfect soil (the kind that's too acid, too sandy, etc.) there's another option. You can learn to live with it.

That's because imperfect soil isn't necessarily infertile soil. It *does* require the addition of nitrogen from time to time (via manure, compost, rotted leaves, or some

other kind of fertilizer), but then so does perfect soil. Imperfect soil is, in fact, what covers most of this imperfect planet, and many beautiful plants have fully adapted to one or another of its imperfections. That is, they don't merely do okay in it; they do best in it.

Conclusion: Unless you want to grow County-Fair-quality flowers or a wide variety of food plants, it's sensible to forget all-out effort at soil amendment and make do with what you've got. If you're not sure just what that is, take a soil sample to your local nursery or County Agent. Then buy what's appropriate: acid-loving plants for acid soil, etc.

SOIL CHART

Problem	Remedy
Poor drainage. Most often occurs in clay-type soil, which consists of very tiny soil particles that tend to compact, allow little air circulation and very slow downward movement of water.	Add ground bark, peat moss, sawdust, leaf mold, etc. They decompose to make humus, a soft material that binds tiny clay particles into large crumbs, improves aeration and drainage.
Excess sandiness. Sandy soil consists of large particles. They allow good aeration and quick draining, but may cause leaching away of essential soil nutrients.	Responds well to mineral amendment via addition of pumice, perlite, vermiculite, but treatment is very expensive for large areas. Slower balance can be achieved by adding ground bark, peat moss, etc., as above.
Excess acidity. Most common in high rainfall areas, especially in Eastern half of the U.S.	Moderately acid soil is tolerated by many plants, should usually be left as is. Highly acid soil can be treated by addition of lime. Be sure to avoid fertilizers that produce acid reactions.
Excess alkalinity. Soil too high in lime content; most common in low-rainfall areas.	Moderately alkaline soil is tolerated by many plants, can be significantly improved by use of acid-type fertilizers, liberal watering. Improve drainage by methods recommended for clay-type soils.
Excess salinity. Symptoms: stunted growth; scorched-looking leaves with brown, withered edges. Condition is most common in low-rainfall areas, may also be caused by use of chemically softened water for irrigation.	Leach by periodic heavy watering. If drainage is slow, improve by methods described above.
Chlorosis. Symptom: Yellowing of leaves while leaf veins remain dark green. Caused by iron deficiency.	Treat soil with iron chelates or iron sulfate, available in most nurseries. Avoid over-dosing.
Nutrient deficiency. Symptom: plants grow poorly even though there is good drainage, plenty of water, and no excess of acid or alkaline. Cause: lack of nitrogen and other nutrients. Problem occurs even in once-good soil as plants withdraw nutrients to support their growth.	Correct quickly by regular use of nitrogen-phosphorous-potassium fertilizers. Or correct more slowly by continuing use of manure, compost, other organic supplements.
Shallow-soil hardpan. Condition: soil is only inches deep over brick-like, compacted subsoil. Symptoms: water can't drain downward, roots can't penetrate, plant growth is virtually impossible for all but most shallow-rooted species.	For individual plantings, try using soil auger or posthole-digger to make large planting holes: 6 ft. wide by 3 ft. deep for trees, 3x3 ft. for shrubs, $1\frac{1}{2}$x$1\frac{1}{2}$ ft. for flower borders. Fill with well-mixed combination: half soil from the hole, half peat moss or ground bark fortified with ammonium nitrate and super-phosphate. Or treat whole area by scarifying with heavy equipment to $1\frac{1}{2}$-2 ft. depth; then add soil amendment material equal to 25%-50% of total soil volume.

Consider the mini-climate. Naturally, the general climate in your area determines what kinds of plants will work in your garden: annuals and hardy perennials where winters are cold, succulents and other drought-resisters where summers are hot and dry, and so on. And if you do all your plant-buying at a local nursery (rather than from one of the national mail-order houses), chances are you won't go too far wrong. Local nurseries obviously don't stock plants that can't take the local climate.

But in many cases your efforts will be a lot more satisfactory if you consider not just the general climate, but also the little pockets of mini-climate at various spots on your property. One example: In an area with light-to-moderate frost, geraniums probably won't make it through the winter if they're planted out in the open; or if they're against a fence where lack of air movement allows cold air to collect and settle. But planted near (though not against) a south wall of your house, the combination of warmth from the house, the feeble winter sun, and adequate air movement may be enough to see them through.

Expect changes. Even if you don't plan it that way, just about everything you do to your garden affects the balance of the soil, shifts the patterns of sun, shade, and wind, and generally changes the way it works. So watch for the changes, and respond to them as they happen. And remember that once you start working with your garden, you're part of the ecosystem, too. L.M.B.

See also: FERTILIZERS; FLOWER CARE; FLOWERING BULBS; GARDENING.

Know the rooting and climbing habits of any vine planted near the house. Plants like this creeping fig look delicate but they require regular cutting-back control.

Quick growing shrubs like this rice paper plant should be set in containers. Ideal for instant greenery, they may be too aggressive to plant along with weaker species.

Plants That Solve Gardening Problems

Use this guide to find the plants you need to meet the conditions in your landscape or garden. Except where noted, species here can be grown in all U.S. climate zones

PROBLEM SOLVING PLANTS

How to Choose Plants that will Thrive in Your Soil

To get the most out of your garden with the least effort and expense, choose plants that prefer the kind of soil bestowed upon you by Nature and your real-estate agent. Determine the soil's alkaline/acid makeup (its "pH rating," to use the scientific phrase) via a pH gauge or soil-test kit, available at low cost from your nursery or County Agent; and then select accordingly. Keep in mind, though, that the soil should be re-tested from time to time, because the plants you choose today may change the pH rating next year.

These plants like acid soil (pH 4.0-6.0)

Azalea	Heather	Pine
Blackberry	Huckleberry	Radish
Blueberry	Lily	Raspberry
Chrysanthemum	Lily-of-the-valley	Rhododendron
Cranberry	Marigold	Spruce
Evergreens	Mountain laurel	Sweet potato
Ferns	Oak	Watermelon
Heath	Pecan	Yew

These plants like slightly acid soil (pH 6.0-6.5)

Apple	Endive	Peach
Apricot	Gardenia	Pear
Beans	Gloxinia	Pumpkin
Bent grass	Gooseberry	Rhubarb
Bluegrass	Grape	Snap beans
Cherry	Kale	Squash
Corn	Pansy	Strawberry
Eggplant	Pea	Tomato

These plants like neutral or alkaline soil (pH 7.0-7.5)

Alyssum	Cantaloupe	Lettuce
Asparagus	Carrot	Onion
Beet	Celery	Quince
Broccoli	Clover	Spinach
Cabbage	Cucumber	Swiss chard
Carnation	Iris	Zucchini

For pH preferences of other common plants, check with a knowledgeable nurseryman.

PROBLEM SOLVING PLANTS

Quick Shade, Quick Screening

The most important plants in any landscape are the ones that provide privacy, shade and separation. Thousands of plants do it well, but the ones listed have a special virtue: they grow fast enough to start doing their job effectively in the first year of planting. The trees and tall shrubs are major screens, best used around the perimeter of your garden. The smaller plants can be used to separate and define various areas within the garden.

Plant name	Type	Comments
Ailanthus altissima (Tree of Heaven)	Deciduous tree	Grows fast to 50 feet, tolerates poor soil.
Alnus rhombifolia (White alder)	Deciduous tree	To 50 feet, wide spreading, very fast growth with lots of moisture; not feasible in dry desert climate.
Alnus glutinosa (Black alder)	Deciduous tree	Not as fast growing as *rhombifolia*, but okay for all climates including desert. Has dense foliage near ground, makes fine screen long before full maturity.
Betula (Beech)	Deciduous tree	Fast early growth, eventually reaches 50-90 feet. Many varieties; check for best in your area.
Ceanothus (Liliac)	Shrub, small tree, most evergreen	Many varieties; most do best without too-frequent watering. Wide range of flower colors.
Colocasia esculenta (Elephant ears)	Perennial	Huge, tropical-looking leaves. Evergreen moderate climates; in cold climate, grow in containers or lift and store tuberous roots through winter.
Cornus stolonifera (Dogwood)	Deciduous shrub	To 15 feet, thrives in all but desert areas. Though foliage drops in winter, bright-red twigs make light, attractive winter screen.
Forsythia intermedia	Deciduous shrub	Fine cold-climate plant; to 10 feet with long, arching branches. Foliage drops in winter but thick yellow blossoms appear on bare branches as early as February.
Lavatera trimestris (Annual mallow)	Annual	Quick, temporary summer hedge; grows 3-6 feet from seed sown in spring. Big flowers, many colors, long bloom.
Morus alba (Mulberry)	Deciduous tree	Fruitless forms preferred by most gardeners. To 35 feet. Grows fast in all climates, fastest in hot sun, alkaline soil; good desert screen-shade tree.
Paulownia tomentosa (Empress Tree)	Deciduous tree	Grows fast all climates; young trees may need protection in coldest areas. Heavy trunk, tropical-looking foliage. To 40 feet with blue flowers, but if cut back frequently will grow as lower, billowing mass of foliage.
Philadelphus (Mock orange)	Shrub	Many varieties, most deciduous, some evergreen. Very hardy, fast-growing to 6-10 feet; fragrant spring flowers. Check for best local type.
Phyllostachys bambusoides (Bamboo)	Giant grass	Many varieties, all fast-growing, some invasive spreaders. Hardiest varieties, p. *viridus* and p. *aureosulcata*, can take cold to −10°, −20°, grow to 15-30 feet. For fastest growth, water and feed as often as lawn grass.
Pinus (Pine)	Evergreen trees; some with shrub-like growth	Among the hardiest, most varied and adaptable evergreens; some varieties make quick, permanent evergreen screens of low to moderate height. Check for best local performers.

Plant name	Type	Comments
Pyracantha coccinea (Firethorn)	Evergreen shrub	Dark-green year-round foliage, bright orange fruits; thorny branches make for good "barrier" screen. Size, shape easily controlled by pruning. Very vigorous and hardy. To 8-10 feet with normal growth, to 20 feet if trained against wall.
Rhus (Sumac)	Shrubs, some evergreen, some deciduous	Deciduous varieties are hardy in all climates, thrive in poor soil. Evergreens are less hardy, need well-drained soils. Species includes poison oak and poison ivy, both of which should be destroyed if they appear on your property. Check for best local growers.
Ricinus communis (Castor bean)	Annual	Bold-leafed shrublike plant makes handsome temporary screen, can grow 6-15 feet in one season. Leaves are allergenic, seeds highly poisonous.
Wisteria	Vine, tree, shrub; deciduous	Very hardy, fast-growing vine for trellis, arbor; or use as tree, shrub with appropriate pruning. Dense flower clusters make unusually beautiful spring-summer screen.

In addition to the mostly deciduous screening plants listed above, gardeners in moderate climates can get quick year-round screening from these fast-growth evergreens:

Acacia
Acanthus mollis
Choisya ternata (Mexican orange)
Cistus (rockrose)
Cotoneaster lactea
Dodonaea viscosa
Eriobotrya deflexa (loquat)
Eucalyptus
Fatsia japonica
Ligustrum lucidum (privet)
Philodendron
Phormium tenax (New Zealand flax)
Prunus laurocerasus (English laurel)
Romneya coulteri
Ulmus parvifolia (Chinese elm)

▲ *Nicotiana blossoms in summer with red, white and yellow flowers.*

◀ *For spring blooms, try double golden dwarf, a member of the calendula family.*

Ageratum is a summer-blooming annual.

PROBLEM SOLVING PLANTS

Flowers for Year-Round Color

No flowers bloom all of the time, but all flowers bloom some of the time—and no matter where you live you can get year-round garden color by careful planning-ahead with the annual, perennial, and bulb-type flowers listed here. They're all adaptable enough to thrive in all U.S. climate areas, and all have moderate-to-long blooming periods: a minimum of one month, with some spanning two full seasons. Best planting time for most of these flowers is fall or early spring, but check with local nurserymen to determine the optimum time for your own area.

Color Code: **B**-blue; **L**-lavender or purple; **M**-multi-color; **O**-orange; **P**-pink; **R**-red; **W**-white; **Y**-yellow

Flowers for Spring Bloom

Plant name	Type	Comes in these colors
Alyssum saxatile	Perennial	Y
Anemone coronaria	Bulb	B,L,M,P,R,W
Antirrhinum majus (snapdragon)	Annual	L,M,O,P,R,W,Y
Aquilegia (columbine)	Perennial	B,L,M,P,R,W,Y
Bellis perennis (English daisy)	Perennial	P,R,W
Calendula officinalis	Annual	O,Y
Calochortus	Bulb	B,L,W,Y
Centaurea cyanus (bachelor button)	Annual	B,L,P,R,W
Clarkia	Annual	L,O,P,R,W,Y
Crocus	Bulb	B,L,M,O,P,W,Y
Cynoglossum amabile	Biennial	B,P,Y
Delphinium ajacis (larkspur)	Annual	B,L,M,P,R,W
Dianthus (carnation, pink)	Perennial	L,M,O,P,R,W,Y
Dianthus barbatus (sweet William)	Annual	L,M,P,R,W
Digitalis purpurea (foxglove)	Perennial	L,M,P,R,Y
Helleborus	Perennial	L,M,P,W,
Heuchera sanguinea (coral bells)	Perennial	P,R,W
Hyacinthus orientalis	Bulb	B,L,O,P,R,W,Y
Iberis sempervirens (evergreen candytuft)	Perennial	W
Iris, bearded	Bulb	B,L,M,O,P,R,W,Y
Iris, Dutch	Bulb	B,L,M,O,W,Y
Lathyrus ordoratus (sweet pea)	Annual	B,L,P,R,W
Linaria maroccana	Annual	B,L,M,P,R,Y
Lobularia maritima (sweet alyssum)	Annual	L,M,P,W
Matthila incana (stock)	Annual	B,L,P,R,W,Y
Muscari	Bulb	B,L,W
Myosotis sylvatica (forget-me-not)	Annual	B,M,W
Narcissus (daffodil)	Bulb	M,O,W,Y
Nemesia strumosa	Annual	B,L,M,O,P,R,W,Y
Ranunculus asiaticus	Bulb	M,O,P,R,W,Y
Tulipa (tulip)	Bulb	L,M,O,P,R,W,Y
Viola cornuta	Perennial	B,L,O,P,W,Y
Viola odorata (sweet violet)	Perennial	L,R,W
Viola tricolor hortensis (pansy)	Annual	B,L,M,O,P,R,W,Y

Flowers for Summer Bloom

Plant name	Type	Comes in these colors
Achillea (yarrow)	Perennial	R,W,Y
Ageratum houstonianum	Annual	B,L,P,W
Amaranthus	Annual	R
Aster	Perennial	B,L,P,R,W
Browallia americana	Annual	B,L
Callistephus chinensis (China aster)	Annual	B,L,P,R,W
Canna	Bulb	M,O,P,R,W,Y
Catharanthus roseus	Perennial	M,P,R,W
Chrysanthemum maximum (Shasta daisy)	Perennial	W,Y
Convolvulus tricolor (dwarf morning glory)	Annual	B,M,R
Coreopsis grandiflora	Perennial	Y
Coreopsis tinctoria	Annual	M,O,R,Y
Cosmos	Annual	L,M,O,P,R,W,Y
Dahlia	Bulb	L,M,O,P,R,W,Y
Gaillardia grandiflora	Perennial	M,R,Y
Gaillardia pulchella	Annual	O,R,Y
Helianthus annuus (sunflower)	Annual	O,Y
Hemerocallis (daylily)	Bulb	M,O,P,R,W,Y
Impatiens holstii	Annual	O,P,R,W
Ipomoea (morning glory)	Annual	B,L,M,P,R,W
Iris kaempferi (Japanese iris)	Bulb	L,P,R,W
Lilium (lily)	Bulb	L,M,O,P,R,W,Y
Limonium	Annual	B,L,P,W,Y
Lobelia erinus	Annual	B,L,M,P,W
Mimulus tigrinis	Annual	M,Y
Nicotiana	Annual	R,W,Y
Nymphaea (waterlily)	Bulb	B,L,O,P,R,W,Y
Petunia hybrida	Annual	B,L,M,P,R,W,Y
Phlox drummondii	Annual	L,M,P,R,W
Portulaca	Annual	L,O,P,R,W,Y
Salvia splendens (scarlet sage)	Annual	L,P,R
Tagetes (marigold)	Annual	O,Y
Tigridia pavonia	Bulb	M,O,P,R,W,Y
Tithonia rotundifolia	Perennial	O,R
Tropaeolum majus (nasturtium)	Annual	M,O,P,R,W,Y
Verbena hybrida	Annual	B,L,M,P,R,W
Zinnia	Annual	B,L,M,O,P,R,W,Y

Flowers for Fall Bloom

Plant name	Type	Comes in these colors
Anthemis tinctoria	Perennial	Y
Chrysanthemum morifolium	Perennial	L,M,O,P,R,W,Y
Chrysanthemum frutescens (marguerite)	Perennial	P,W,Y
Colchicum autumnale	Bulb	L,P,W
Echinops exaltatus	Perennial	B
Francoa ramosa	Perennial	P,W
Helenium autumnale	Perennial	O,R,Y
Sedum spectabile	Perennial	P,R
Stokesia laevis	Perennial	B,L,W
Zephyranthes	Bulb	M,P,R,W,Y

Flowers for Winter Bloom

Plant name	Type	Comes in these colors
Calendula officinalis	Annual	O,Y
Dimorpholheca (African daisy, Cape marigold)	Annual	L,M,O,W,Y
Helleborus	Perennial	B,M,P,W
Iberis (candy tuft)	Annual	L,P,R,W
Iberis sempervirens (candy tuft)	Perennial	W
Iris, Dutch	Bulb	B,L,M,O,W,Y
Lobularia maritima	Annual	L,P,W
Papaver nudicaule (Iceland poppy)	Annual	O,P,W,Y
Viola cornuta	Annual	B,L,O,R,W,Y
Viola tricolor hortensis (pansy)	Annual	B,L,M,O,P,R,W,Y

PROBLEM SOLVING PLANTS

Plants that Attract Bees

Practically everything that blooms draws some bees, but these plants do it a lot more than most. Avoid putting them near your patio-dining-playing areas.

Abelia
Acacia
Arenaria verna (Scotch moss, Irish moss)
Artemisia (including tarragon)
Buddleia (butterfly bush)
Callistemon citrinus (bottlebrush)
Calluna (Scotch heather)
Ceanothus (lilac)
Choisya ternata (Mexican orange)
Clover
Cotoneaster
Crataegus (hawthorn)
Erica (heath)
Escallonia
Eucalyptus
Gleditsia (honey locust)
Heteromeles (California holly)
Iceplant
Ligustrum (privet)
Lonicera japonica Halliana (honeysuckle)
Phyla nodiflora (lippia grass)
Pyracantha
Rosmarinus officinalis (rosemary)
Teucrium chamaedrys (germander)
Thymus (thyme)
Salvia (sage)
Wisteria

Plants Not to Put Near the Tot-Yard

Many plants are poisonous, including the common garden varieties listed here. Unless you're willing and able to do a lot of careful supervising, don't plant them in easy reach of toddlers. All these plants can make a child (or even an adult) very sick; the ones powerful enough to be fatal in small amounts are marked with an asterisk(*).

Plant name	Toxic part
Azalea, rhododendron*	All parts
Crocus	Bulbs
Daffodil	Bulbs
Elephant ear	All parts
Foxglove	Leaves
Hyacinth	Bulbs
Iris	Underground portions
Larkspur	Seeds, young plants
Laurel*	All parts
Lily-of-the-valley	Leaves, flowers
Mistletoe*	Berries
Narcissus	Bulbs
Oleander*	Leaves, branches
Poinsettia*	Leaves
Rhubarb	Leaf blade
Ricinus (castor bean)*	Seeds
Rosary pea*	Seeds
Star-of-Bethlehem	Bulbs

Barrier Plants

Plants with stickers and thorns may be a pain near patio, pool, or ping-pong table, but they're problem-solvers in any area where you want to discourage foot traffic, short-cutting, or trespass. Here are some of the most effective.

Plant name	Type
Berberis thunbergii	Deciduous shrub
Blackberry	Shrub; trailing shrub
Chaenomeles (Flowering quince)	Deciduous shrub
*Cortaderia selloana (Pampas grass)	Giant grass

Plant name	Type
Cotoneaster dammeri (Bearberry)	Evergreen shrub
*Elaeagnus pungens	Evergreen shrub
*Itea ilicifolia	Evergreen shrub
Juniperis chinensis Pfitzeriana (Juniper)	Evergreen shrub
*Osmanthus heterophyllus	Evergreen shrub
Pyracantha coccinea	Evergreen shrub
Rosa multiflora (Rose)	Deciduous shrub
Rosa "Mermaid"	Deciduous shrub

* Not suitable for areas with winter lows below 0°

Zinnias bloom in a wide range of colors.

These mixed sunburst dahlias bloom in summer in a variety of colors.

Spring-blooming Dianthus plants are available in both perennial and annual types.

Build a Little Red Barn

Use this easy-to-build shed as a playhouse, garden tool shed or poolside dressing room, or as a garage for a motorcycle or garden tractor

GARAGING A CAR these days is complicated by the fallacy that there's always room for one mower. If your home has the storage blues, this project is the best tonic you could ask for.

It's quite possible that your youngsters are at the age where they need a playhouse; if so, they'll love this barn. Or, you may wish to use it for a workshop. Gardeners find that it makes an excellent potting shed. You couldn't find a more suitable garage for motorcycles or garden tractors. If you have a pony, here's his barn. Install bunks and you have a dandy extra room. When used beside a pool, you have an ideal dressing room which can be converted into a barn or a hot dog stand for outdoor entertaining. If it rains, here's shelter for your outdoor furniture. Other applications are limited only by your imagination.

The dimensions of the barn pictured are 6 x 8 x 8 feet, which is suitable for most purposes. If, however, you need something larger you can easily alter the plans to take care of the extra size.

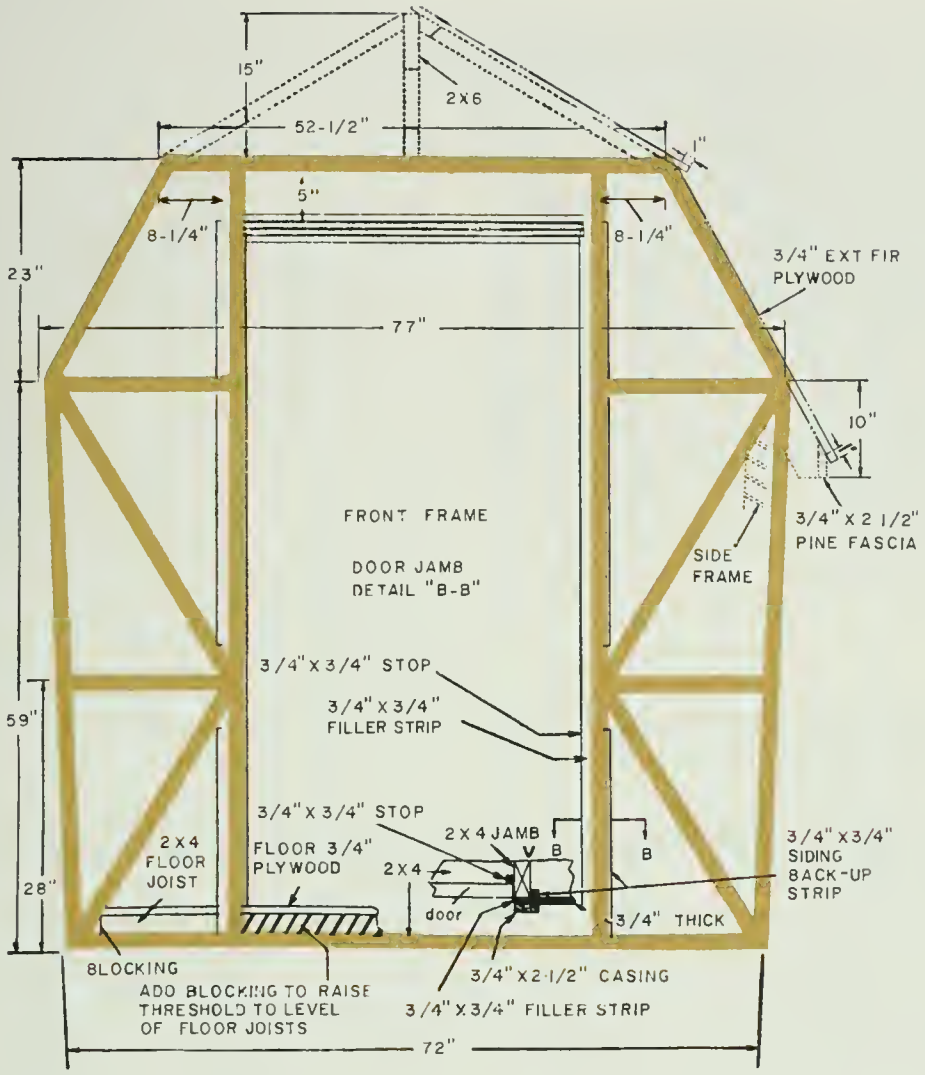
While a hammer and saw are about the only tools needed for this project, we suggest use of a plumb bob, a square, and a level to make sure of a perfect job. Get the best hammer you can; you can work faster, more accurately, and longer with a well-balanced hammer than with a poor one. If you don't have a power saw, buy or rent one and you'll save a lot of time and work.

Foundation for the shed can be a footing of concrete blocks laid on their sides, and end to end, with no mortar between them. However, if you intend to have more substantial footing, and possibly a concrete slab floor, check with your local building department so that you can comply with permit requirements for erecting permanent structures.

Dig up grass or any other vegetation in the area where the shed is to be erected. If this isn't done, the greenery will start to rot under the flooring once it is deprived of sunlight, and you'll have an unpleasant odor. Level the ground carefully, and tamp the earth down so that it won't settle under the weight of the shed at any point.

Place the blocks in position, making sure that their tops are absolutely level and square with each other. Lay them out so their outer edges will be flush with the outer edges of the front, rear, and side frame

gas heating: see fuels
gasket replacement: see engine
gates: see home improvement
gauge, dashboard: see electrical, auto
generator: see dc generator

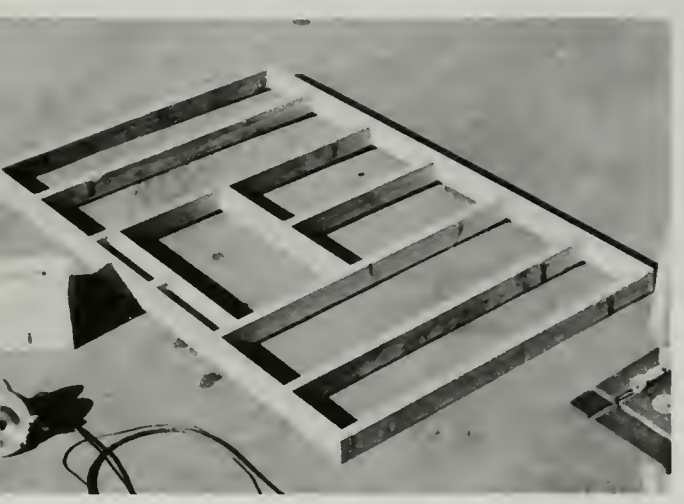


▲ *Broken lines at top of front frame are installed temporarily so frame can be pattern for rafter assembly. Short length of 2x6 is in ridge beam's position.*

members. This is done so that the siding, when installed, will overlap the blocks by about 1 inch.

Now you are ready to make up the front, rear, and side frames, using 2 x 4 stock. Start with the front frame, taking the dimensions from the drawing. You will note that the sides are canted out slightly to give the shed a more rustic appearance. Mark and carefully cut the diagonal members so that you get a good, snug joint. It is in attention to such details that the home craftsman often surpasses the professional in workmanship. Use at least two nails at every joint.

At this time the rafter members and ridge beam support are nailed in place temporarily on the front frame, with a short length of 2 x 6-inch stock in the ridge beam position. This will be used as a pattern for



Uprights of side frames are on 16-inch centers. Windows can be installed on either or both sides.

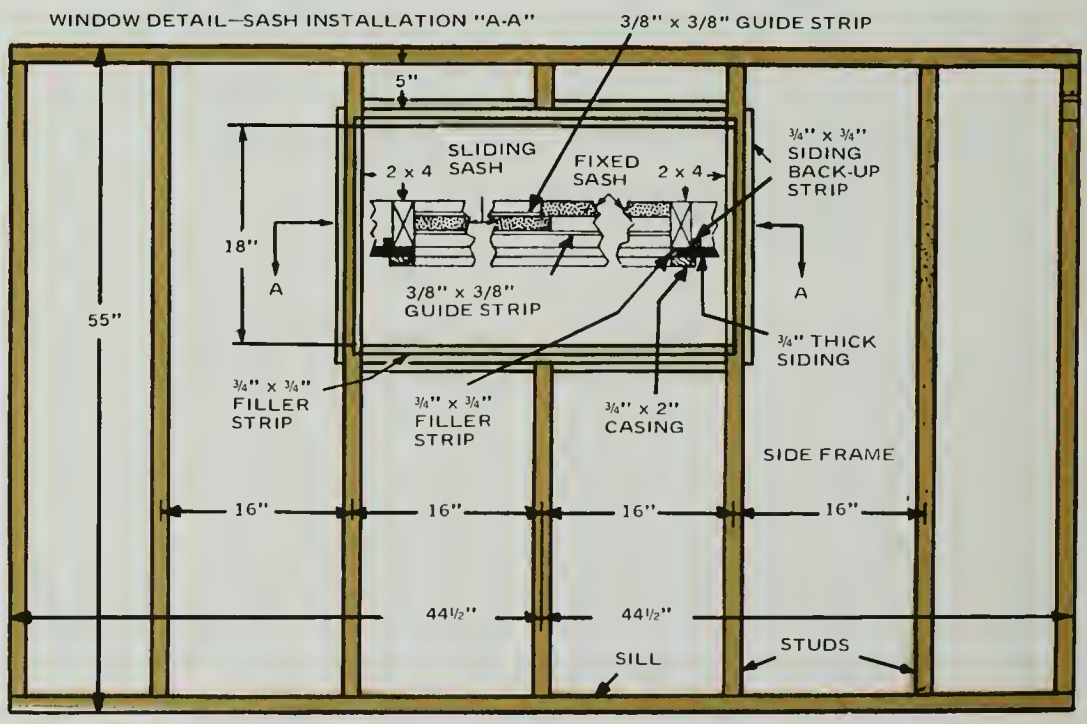
Drawing shows window with one fixed and one sliding sash.

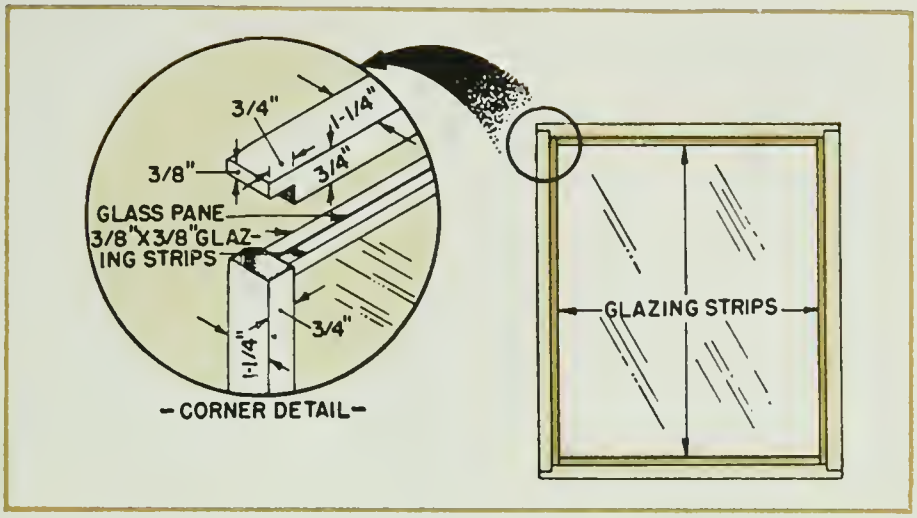
the other rafters. Also, you can now install the ¾ x ¾-inch door stop pieces, the siding back-up strips, and the filler strip around the door before the frame is set up in place.

Make up the rear frame, with the four full-length uprights (studs) on 8-inch centers. The horizontal bracing is staggered so that you can nail through the uprights into the ends of the bracing members. Cut and nail the rafter and ridge beam members permanently in place.

Side frames are constructed with the uprights on 16-inch centers. A window can be installed on either side or both sides, if desired. You can make the windows any desired size, or to fit standard units available from lumber dealers.

If you make up the window shown in the illustrations, the exact height of the fixed sash is that of the window opening in the side frame (the drawing shows an opening 18 inches high). The sliding sash should be





Width of fixed and sliding sash must be half window opening plus 3/8-inch each. Fixed sash is exact height of opening; the sliding sash 3/16-inch less in height.

made $\frac{3}{16}$-inch less in height to allow it to slide easily. Sash frames are made up of ¾ x 1¼-inch stock, with the inside dimensions of the frame matching the dimensions of the glass to be installed. Top and bottom members are mortised ⅜ x ¾-inch to take the side members. Install ⅜ x ⅜-inch glazing strips around the inside of the frame, along the edge that will face the interior of the shed. Then nail the frame in place in the window opening; the glass will be installed, with the exterior glazing strips, after the shed has been erected. The sliding sash is made up in the same manner, except that glass and exterior glazing strips are installed at this time, and the whole unit goes in place after the shed is up. Width of both the sliding and the fixed sash must each be half of the window opening measurement, plus ⅜-inch.

At this point, however, it is a good idea to install the inner guide strip for the sliding sash, plus the siding back-up strips, filler strips, and casing.

Now mark off the exact height of the side frames on each side of the front frame. Make up the five rafter assemblies, using the front frame as a pattern. Be sure to notch both sides of each rafter assembly at the point marked for the height of the side frames. In this manner, all rafter frames will be identical, and your finished roof will have no unsightly dips or bulges.

When the rafter assemblies are finished, cut out and install the "mini rafters" in place on front and rear frames. Remove the 2 x 6-inch piece from the front frame, and fasten the rafter members and ridge beam support in place permanently.

At this point you are ready to set up the frames on the foundation. It's a good idea to use long scraps of 2 x 4 stock to brace each frame in position temporarily. One end of the 2 x 4 is nailed to a high point on a frame, and the other end is placed on the ground. By moving the end on the ground forward or backward, you can adjust the frame until it is in the correct position.

Start with the front frame. Make sure the outer edge of the bottom members (the sill) is flush with the outer edge of the concrete blocks. Adjust the temporary supports until the frame is exactly perpendicular. Next place one of the sides in position, and adjust it so that it lines up with the outer

edge of the front frame. Nail it in place with a few nails, and proceed to erect the second frame in the same manner. Finally, place the rear frame in position. Make sure it is exactly perpendicular, and that the side frames are aligned with its outer edges. Nail it in position.

To provide extra strength at end and side joints, lag screws are installed. Use two at each joint; one about a foot from the bottom, one about a foot from the top. Be sure to drill pilot holes to avoid splitting the wood.

Rafters are installed next, one above each pair of matching studs in the side frames. Make sure they are square with the sides, and exactly perpendicular. Cut the ridge beam to the proper length, and slip it into place so that it rests on its supports at each end. Nail the upper ends of all rafter members to it.

Next install blocking between the rafters along the tops of the side frames. The outer upper edges of the blocking must be flush with the outer edges of the rafters, as these blocks seal the gap that would otherwise exist between the roof and the sides when the side panels are installed. Spacers are also nailed between the rafters at the upper joint.

Cut and install the floor joists next. Note that they are notched at each end so that they rest on the concrete blocks as well as the sill. Install blocking between the studs of the front and rear frames to provide support for the floor panels here.

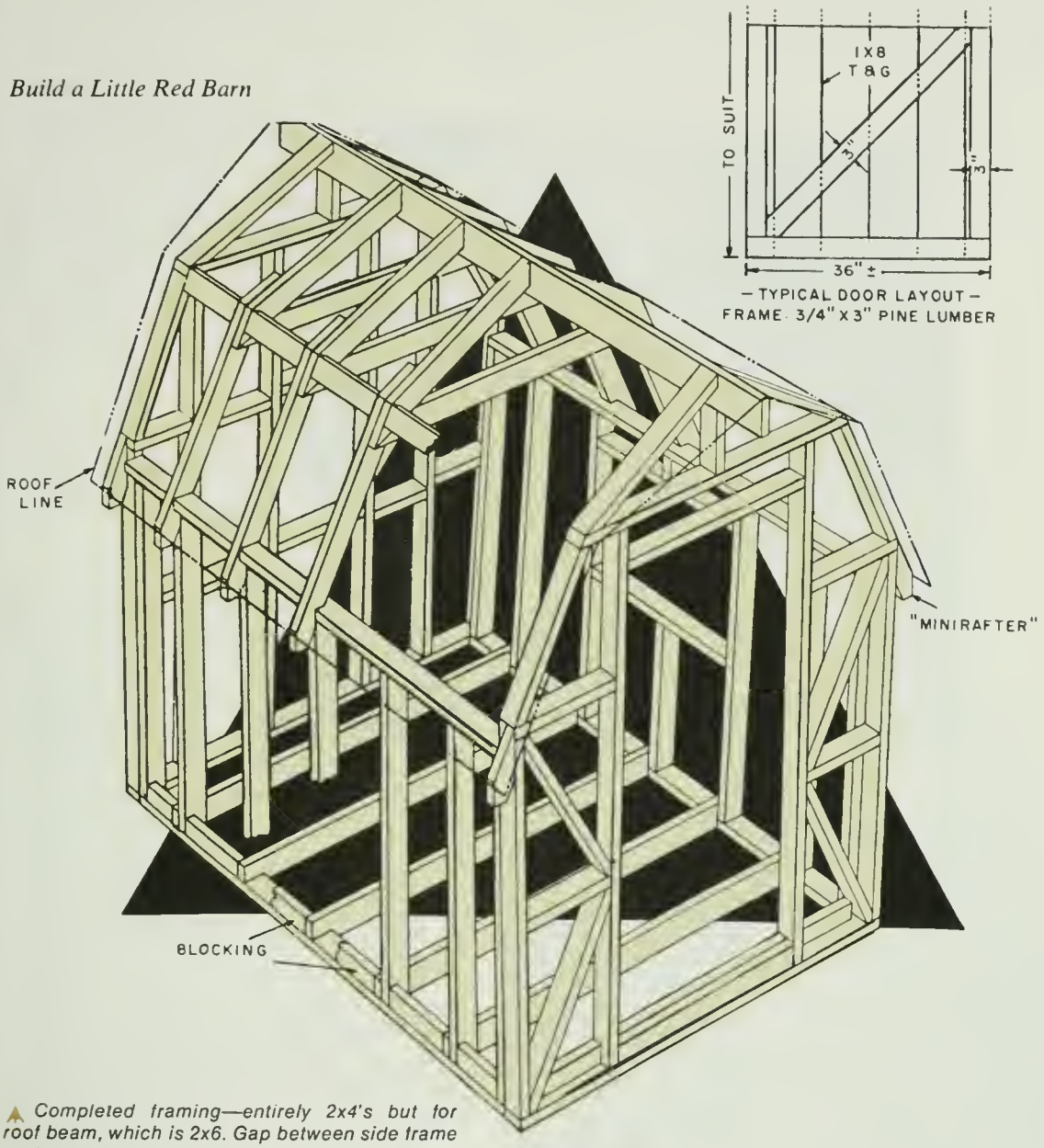
Cut out the floor panels using ¾-inch exterior grade plywood. Be sure to notch the panels to accommodate the studs. Install the four corner panels first, then the two side panels, and finally the center panel.

It is suggested that floor joists, and the under sides of the floor panels, plus the sills, all be treated with preservative before the panels are nailed in place. This provides protection against termites, and of course it can't be done after the flooring is in place.

Roof panels are also ¾-inch exterior

Simplicity of the rafter assembly is evident in this photograph; five of them are required. Use front frame as a pattern. Notch sides of each for height of side frames. With identical rafters, the roof will have no dips or bulges.

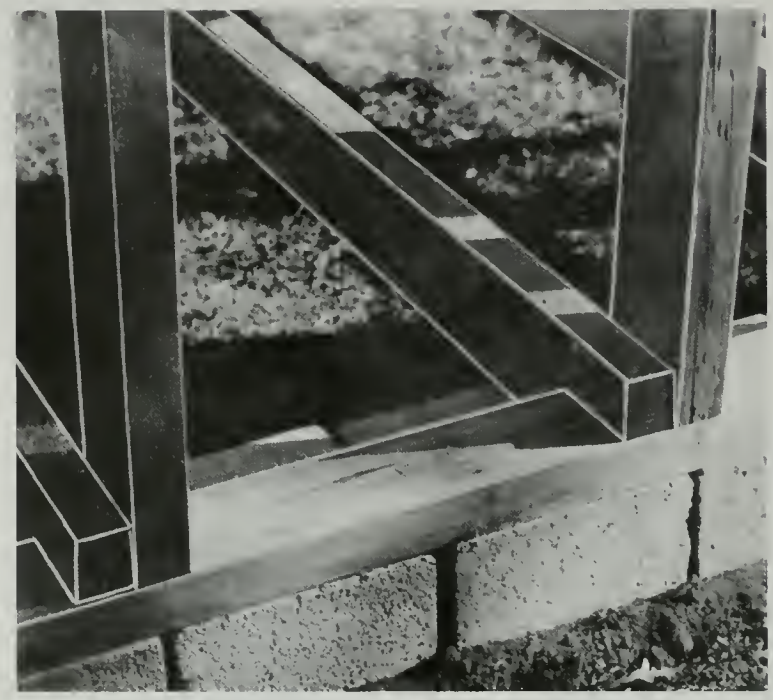
With rafter assemblies completed, cut out and install "mini rafters" on front and rear frames. Temporary 2x6 is now removed from front frame and rafter members and ridge beam put up.



▲ *Completed framing—entirely 2x4's but for roof beam, which is 2x6. Gap between side frame and roof is sealed by blocking. Attach to tops of side frames between rafters. Note that height of door can be varied.*

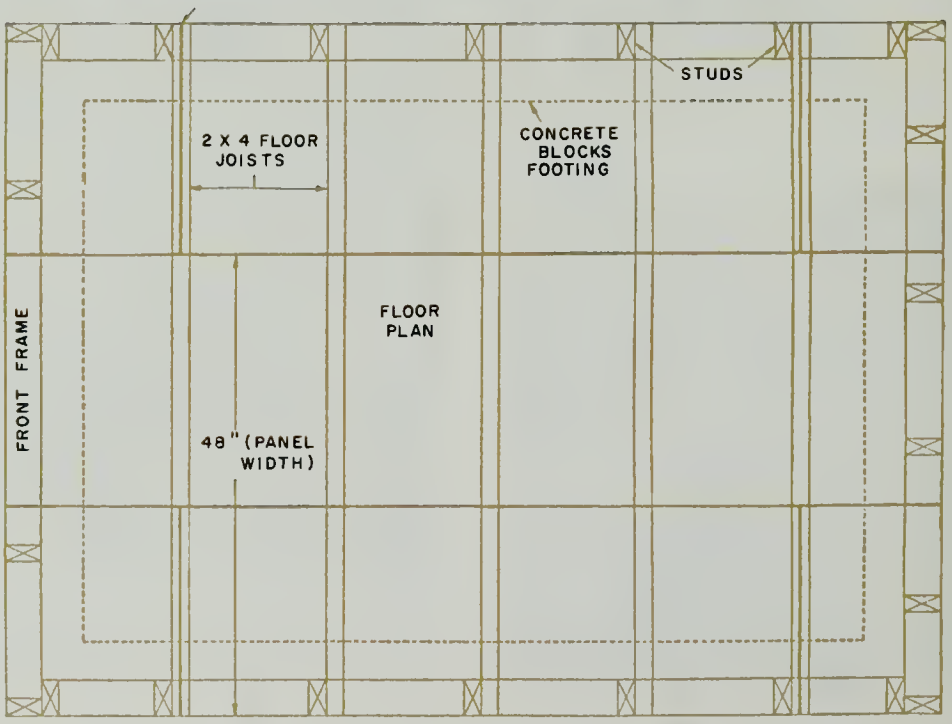
grade plywood. The upper panels should be cut about 34 inches wide; the bottom panels about 36 inches. As the roof is longer than 8 feet—the standard length of plywood sheets—it is necessary to make up each panel in two sections. Be sure to make each joint on a rafter. Install bottom panels so they overlap the ends of the rafters by about 1 inch and then the upper panels so they overlap the bottom panels by about 1 inch.

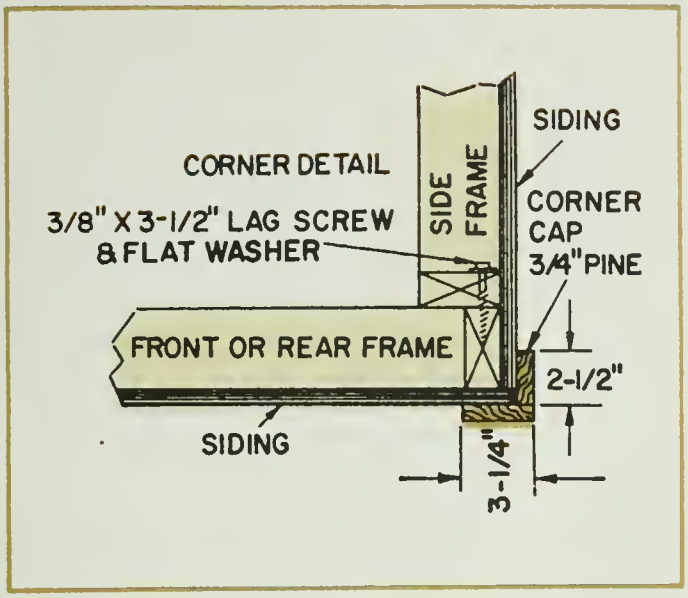
Now nail the siding in place. This is tongue-and-groove stock; the tongue should be on the upper end of each plank; the groove on the bottom. This will prevent water from getting trapped in the joints. Start at the bottom and work up. Cut the stock a few inches longer than necessary. Install a side piece first, letting it overlap



Floor joists are notched on ends so they can rest on sill and concrete blocks. Blocking is put between studs of front and rear frames to provide support for the floor panels.

Heavy lines indicate cutting pattern for the 3/4-inch plywood floor. Outer edges of panels are notched to accommodate studs of front, rear and side frames.





A corner cap is installed at each corner of the barn. You can make them up as shown, or buy ready-made cap strips at a lumber yard.

the front and rear frames. Be sure it also overlaps the concrete blocks by at least 1 inch. Nail it in place, then trim the ends flush with the outer edges of the frames at each end. Install the matching piece on the opposite side in the same manner.

Next cut and install the siding pieces at each end, and trim them flush with the sides. Be sure to tap each piece into place so that the tongue is snug in the groove above it before you nail it in place. At the ends it will be necessary to carefully measure, mark, and cut each piece that goes under the roof panels. Also, it may be necessary to notch pieces to fit around the top of the door and window(s).

At each corner of the shed, install a corner cap. You can make this up as shown in the drawing or purchase ready-made wood or aluminum cap strips at your lumber yard. Now, using 1-inch finishing nails, install ⅜-inch quarter-round molding strips along the siding under the roof panels; this will help hide any minor imperfections in the fit of the siding here.

Roofing shown here is red cedar shingle, and you will need four bundles for the job.

Barn with roof panel and most siding on. Roof panels join at a rafter; siding laps concrete block footing by about 1-inch.

Roof area is about 100 square feet, so if you want to use something else your lumber or roofing dealer can help you estimate

your requirements. Again, start from the bottom and work up, staggering each row so that seams along one row of shingles do not overlap the seams in the row below.

Fit and cut the fascia members that go under roof at each end, then install the ¾ x 2½-inch fascia strips that run under the lower edges of the roof panels at the sides. The ends of these strips should butt up against the front and rear fascia members.

Now your window, or windows, can go in place. Place the glass in position in the fixed sash, run a bead of caulking material around the edge to provide a good, weather-tight seal, and nail the exterior glazing strips in place.

Place the sliding sash unit in place, then install the outer guide strips. Note: it is best to paint, or otherwise seal, the inner edges of both the interior and exterior guide strips before the sash is installed, and to paint the sash itself before installation.

Final construction step is to make and install the door. You can make it a double "dutch" door as shown, or a single door. The doors illustrated are made up of ¾ x 3-inch frames backed by 1 x 8 tongue-and-groove planking. Make the doors slightly oversize, then trim them to fit when they are hung. You will choose your own style of hinges, of course, but they should be at least 8 inches in overall length.

If you do not want a permanent ramp that leads up to floor level, make the lower door long enough so that it will extend down below the level of the floor. This will provide a natural weather barrier. However, if you want a ramp up to the floor level, the bottom edge of the door should be flush with the floor, or slightly above it, and a weather strip should be installed.

Before painting the shed, go over the sills and all lower woodwork with wood preservative to provide protection against termites.

The final step, of course, is to paint the shed. While it isn't necessary, it's a good idea to finish the interior as well as the exterior. Modern paints all have good weathering and color retention characteristics; your paint dealer will be able to recommend the products best suited to your needs. If more than one coat is needed on any surface, be sure to use the same brand and type of paint for each coat.

Original design by Steve Ellingson.

See also: FENCE-STORAGE SHED; GARAGE REMODELING; STORAGE.

MATERIALS LIST

Quantity			Purpose
52	2″	4″x8′ lumber of your choice	framing
1	2″	6″x10′ lumber of your choice	ridge beam
42	1″	8″x8′ lumber of your choice	siding
6	3/4″	4′x8′ exterior grade fir plywood	roofing and flooring
1	3/4″	2′x8′ exterior grade fir plywood	flooring
3	1″	12″x8′ lumber of your choice	fascia, corner caps and door framing
as needed	3/8″ quarter round molding		under-eaves trim, front and rear frames
as needed	red cedar shingles		roofing
as needed	#8	1 1/4″ flat head wood screws	doors

NOTE: Also need galvanized box nails, smooth box nails, galvanized roofing nails, hinges, ornamental handle, lag screws, washers and wood preservative.

How to Cut and Install Window Glass

Replacing a window pane is a relatively simple job, and it can be done with a few inexpensive tools and materials

SOONER OR LATER, you'll probably have to replace a piece of broken glass, or at least, cut a piece of glass. This job can easily be done by the layman—there are just a few secrets to be mastered first.

The tips pictured here apply to all except safety glass, which you are not likely to break or have to replace anyway.

The big trick—and this takes practice—is to get a smooth, even cut with the scorer or glass cutter. This weakens the glass along one line and focuses all breaking tendencies along one path.

Don't wait too long after scoring your cutting line before actually breaking the glass in two. Glass, strangely enough, has recuperative powers and the break may not come as easily if you delay.

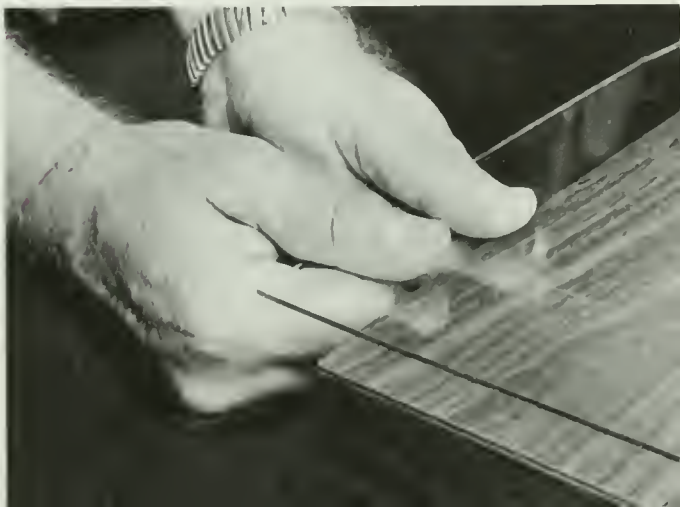
The first step is to wipe the glass clean to eliminate dirt or film which might interfere with a uniform cut. If the glass is new, remove any stickers. Place the glass on a soft, uniform surface. A layer of felt is best, but a layer of newspaper is serviceable.

Use a yardstick or a long metal rule as a guide for cutting. The rule will stay in place without slipping if you dampen it. Hold

▲ *The correct grip. The cutter is held between the first two fingers with the thumb pressed against the underside.*

▲ *Be sure to hold the cutter upright. Draw it along the straightedge guide with a continuous motion. Use firm, even pressure, but remember, you are trying to score the glass, not cut through it.*

▼ *Bend the waste side of the glass down and away from the score in a quick, even motion.*



glassware: see bottle cutting
glue: see adhesives
gouges: see chisels

Narrow edges can be broken away with one of the grooves on the cutter, or ordinary pliers can be used.

Cut-running pliers, like this, is used to break plate glass.

A puttying tool (left) glazing compound (center) a putty chisel (right), a glass cutter and glazing points are all you need to install a piece of glass in a sash.

the glass cutter between the first and second fingers with the thumb on the underside of the handle.

Press the cutter gently, but firmly, against the glass about ⅛-inch from the farthest edge. Be sure to hold it upright. An angle will give you a poor cut. Draw the cutter across the whole surface and off the edge of the glass in a single, continuous stroke, using the straightedge as a guide. Practice beforehand on a piece of scrap to get the feel for the correct pressure and stroke.

After the cut is scored, hold the glass firmly on both sides and break it apart with a quick bending motion, away from the cut. Another way to do this is to slip a straightedge beneath the score and break away the waste.

To break away narrow strips, you can use the slot in the glass cutter.

Another tip: tap the underside of the glass opposite score with the round end of the cutter. This will make the glass break more easily.

To snap plate glass up to ¼-inch thick, use cut-running pliers. This special angled pliers has a sight line that is aligned with the score on the glass. A firm squeeze separates the glass cleanly.

Cutting curves in glass is done by marking the curve on paper and putting it beneath the sheet of glass. Then, with the same continuous motion used in straight cutting, follow the guide line with the cutter.

You may wish to use clear acrylic sheeting, such as Plexiglas, rather than glass, especially where there is a danger that people may break it—in doors, for example, or in full length windows near doors that could be mistaken for entrances, or other hazardous locations.

Clear acrylic glazing material is handled much like glass, except that a special cutter is used to score. After it is scored, the acrylic sheet is snapped apart just as glass is, or it can be placed over a dowel and broken at the score.

Cut the pane of glass slightly smaller than the size of the sash in which it is to fit. Use a heavy-duty putty chisel with a beveled edge to scrape away old putty and smooth the surface of the sash.

When the sash is clear of old putty, insert the new glass and hold it against the wood, while inserting glazing points. The points can be pushed in with a putty knife or a screw driver. Some points come with a driving tool. Special sash clips are needed for steel sashes.

When several glazing points on each side of the glass are holding it in place, apply plain putty or glazing compound. These come in cans from one-half pint to five gallons.

Apply the glazing compound evenly all around with the putty knife. Clean up any excess putty or compound and the job is done. F.C.

See also: ALUMINUM; WINDOW REPAIR; WINDOWS.

HOW TO CHOOSE A GLASS CUTTER

Today you can choose among several different types of glass cutter. Most popular are the ones with steel wheels for general use and diamond-hard carbide wheels for longer life.

Choose superhard carbide wheel cutters for maximum life, easiest cutting and true economy. Precision cutters feature pre-lubricated, low-friction bronze axles and perfect wheel position for clean effortless cutting.

You may also discover turret-head cutters, in the head of which are six different wheels, each of which can be locked into cutting position. Or "refill" wheel cutters, some with magazines in their handles holding six spare replacement wheels.

Plate, polished, laminated or heavy glass is best cut with wheels that have blunt wheels. Extra hard glass is more easily cut with sharp-angle wheel models.

➤ *Place jars over graftings to keep them moist and warm. Keep them in a well lighted area, but out of direct sun. Remove and replace each jar once a day to harden new growth.*

How to Graft Trees and Shrubs

Grafting is a pastime for some serious amateur gardeners, and it is the only method for propagating some plant species

GRAFTING HAS BECOME a pastime for many serious amateur gardeners. The reasons for this are many. One is that certain varieties of trees and shrubs cannot be propagated by cuttings because they refuse to strike roots. The gardener may then plant seeds of the same or a related variety and, when these seedlings are of sufficient diameter, graft a scion, or cutting, to them.

Seedlings are usually very vigorous, having developed a large rootball which will produce enough sap and nourishment to give a terrific push to a small scion grafted to the understock. The grafted plant with an oversized root system will, therefore, grow much faster than a cutting grown plant.

Grafting is performed on both deciduous trees and shrubs—those that drop their leaves in the winter—and evergreens, which hold their foliage throughout the year. Deciduous trees and shrubs are usually grafted after the leaves have fallen and the scions that are grafted to the trunk or branches need no special protection from the weather if they are carefully tied and waxed. In grafting evergreen trees and shrubs, you have one great difficulty to overcome and that is that you must keep the leaves on the scion alive while the graft union is "taking," "knitting," or "healing."

In grafting a scion to an understock, it is necessary that you match up the cambium or living-tissue layers. Unless these layers

grandfathers clock: see clocks
greenhouse: see panels
grinding: see abrasives
gutter repair: see roofs
gypsum panels: see wallboard

are carefully matched, it will be impossible for sap and nourishment to travel up into the scion to keep the leaves from drying up. To preclude having the scion dry up while the graft union is "taking," it is desirable to place a bell jar over the grafted understock so as to provide light for the leaves, and to maintain high humidity inside the bell jar so that the leaves on the scion cannot yield up their moisture.

The trick in evergreen grafting is in "hardening off" the graft when the growth buds begin to push and the new leaves begin to unfold.

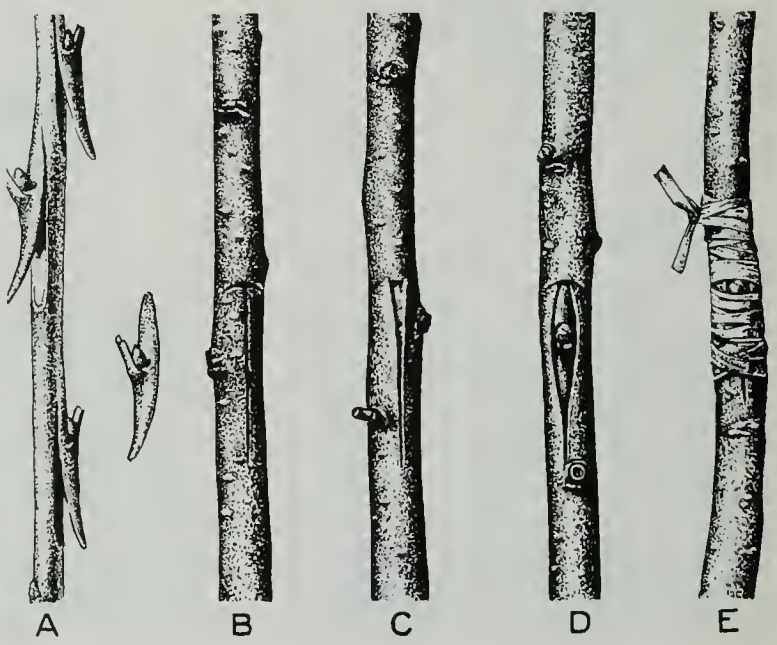
Protective bell jars. One of the problems for the gardener who is grafting evergreen trees and shrubs is to find or make bell jars large enough to cover his grafted plants. Plants which are grafted while growing in gallon cans can be adequately covered by wide mouth, gallon-size mayonnaise jars. Plants growing in jelly pails or in three gallon egg cans will often require the next larger size glass containers. One preferred jar is the common pigs feet jar that is seen in many butcher shops and delicatessens. If the mouth of these jars is not wide enough to slip over your grafted plant, then obviously you will want to crack off the top.

On occasion you may want an even larger glass container. In such instances, look for the purified water bottles often seen in office buildings.

How to remove the tops or bottoms of these jars or bottles without breaking them all to pieces? The trick is to use a burning string. First prepare a mixture of turpentine and motor oil. The motor oil slows down the combustion and keeps the flame going

First step in grafting is to use a very sharp knife to make a long diagonal cut in both scion (the piece to be grafted) and the root stock. Each cut should be at the same angle, so the layers in the root stock and the layers in the scion match when they are placed together. After the two pieces are joined, the graft is wrapped with masking tape.

Rootstock and budwood are cut and matched like this for a side graft. The completed graft is sealed with grafting wax and bandaged.



To make a shield bud graft, first slice off bud and a shield shaped piece of bark above and below the bud (A). Include a thin layer of wood with the bark. Then, make two cuts in the form of a T in the bark of the root stock (B). Peel back the bark of the cut slightly (C) and insert the bud shield in the pocket (D) and bind it with raffia (E).

▲ *Tape may also be used for wrapping, as with potted fruit tree root stock.*

▲ *Plastic bag will keep scions moist and fresh for several days.*

longer. Tie a length of heavy wool knitting yarn snugly around the glass bottle where you want it to break. Meanwhile, have a garden hose running nearby.

Remove the yarn from around the jar and saturate it with the flammable mixture. Put the saturated yarn back on the jar and wipe of any excess liquid. Ignite the yarn and hold the jar horizontal, rotating it slowly.

Continue rotating the jar until the yarn burns through and starts to fall away. Put the jar down quickly and douse it with water from the running hose. You will hear glass cracking. If you were quick enough in setting the jar down and dousing it, you will have an even separation.

Jar sources. Nearly every sizable city has a concern that specializes in cleaning and reconditioning the glass containers found in the city garbage. There you should find the largest selection, and you can buy unclean or damaged bottles. Neighborhood restaurants, bakeries, and delicatessens are good sources of supply for gallon-size mayonnaise and pickle jars as well as the larger pigs feet jars. The concerns selling distilled or purified water should have damaged five-gallon bottles.

Large chemical concerns sometimes have a surplus of large bottles. Since polyethylene containers have pretty much replaced the biggest sizes of glass bottles, the largest-sized acid carboys, running from 15- to 30-gallon sizes, are now a drug on the market. Some hobbyists are making aquariums out of the largest bottles, having the edges ground off smooth after the necks have been cracked off. O.E.H.

See also: BOTTLE CUTTING; GARDENING.

Sketch a simple design on heavy cardboard or wood. Decorate border with beans or seeds.

Fill in the design with colored beans and seeds until the picture becomes a mosaic.

Making Mosaics with Beans and Seeds

You will find hours of enjoyment and escape creating your own designs and seeing them turn into beautiful wall hangings

THESE BEAUTIFUL MOSAIC pictures can be made with the easily found materials, beans and seeds, and will provide hours of enjoyment and satisfaction for anyone. The designs shown in these pictures are only examples. Virtually any design you come up with can materialize in these mosaics.

Simply obtain some dry beans or seeds, heavy cardboard or wood, a pencil and white glue. Begin by sketching a large relatively simple design. Then decorate the edges of the picture with a border design by putting down a thick strip of glue and placing colored beans or seeds next to each other on the line.

Fill in the design with any color scheme that matches the seeds you have available until the entire picture becomes a mosaic. These will look appropriate as wall decorations, centerpieces or placemats. M.E.F.

See also: CRAFT PROJECTS.

handloading: see reloading
handsaw: see saw
hand tool maintenance: see tools

Turn walnut shells into tiny toy animals for children and interesting conversation pieces.

Making Animal Toys from Shells

These little animals are easy enough for a child to make, and all the materials can be found in your home

Use the shells for the animals' bodies; cut the other features from felt, paper or yarn.

WITH THE SIMPLE INGREDIENTS of walnut shells, paints and brushes, felt, paper and glue, you have a recipe for fun and entertainment for children. You can turn these items into tiny toy animals that will be conversation pieces wherever you put them.

Carefully crack the whole walnuts open so the half shells are not broken, and remove the nuts. The shells will serve for the animals' bodies. Then, cut the legs, heads, tails and other features from felt, paper, yarn or anything else your imagination can come up with. You can paint the shells if you wish; then glue the parts on to make your creatures. There is no end to the different kinds of animals you can make if you use a little imagination. M.E.F.

See also: CRAFT PROJECTS.

How to Select Tools

Use this guide to equip yourself with the kind and quantity of tools you'll need for the jobs you want to do – whether you are an apartment dweller with little space or a homeowner setting up a workshop

IT IS POSSIBLE to drive a nail by hitting it with a rock, turn a screw by fitting a thin dime into the slot, even crimp a wire splice with your teeth. But who'd want to do it that way?

Some people strangely manage to get along without any tools at all—not even a screwdriver or pair of pliers. Apparently they never break anything, fix anything, or make anything!

The facts probably are that they either shell out a lot of dough for handyman repairs, or just let everything go to pot—held together with string and chewing gum.

Then there's the other extreme, the collectors who buy and bring home every tool that strikes their fancy, even if they don't know what it's for, stashing it away in hope it will come in handy some day. When the time comes, it's unlikely they can dig out of the mess the one or two items to do the job.

In this many-sided game, the right place is in the middle. That means owning the tools that meet your own particular needs, whether it's a $5 assortment for the young apartment dweller or a well-fitted workshop for the homeowner who can tackle any woodworking or mechanical task.

You should, however, take advantage of the versatility of certain tools to serve additional purposes, and also remember you can rent special tools for one-time use.

But basic tools cost so little it's silly not to have the ones you'll need, even those that will be used only occasionally.

Prices are low. Many hand tools cost $2 or less, and last a lifetime. Examples are screwdrivers, pliers, chisels, awls, punches, hammers, wrenches, squares, rulers and levels. Portable electric tools like drills, sanders and jig saws run from $10 to $40 and are worth their weight in gold. Power tools of good quality (the only kind you should buy) are $75 to $300, the best investment you can make for that money. Prices of tools are actually lower than before because of greater production and intense competition.

When it costs anywhere from $8 to $20 for a simple home appliance repair, a minimum of $8 to get a small window pane replaced, $100 and more just to have some wood trim painted, the cost of tools and

handy carrier: see tool caddies
hardware, furniture: see cabinets
hatchet: see knives and axes
headlight switch: see automobile
heating costs: see fuels

equipment that enable you to do these jobs yourself is insignificant and is repaid many, many times over. Besides freeing your household from reliance on undependable outside service, these chores give you an unmatched sense of satisfaction and stimulate further improvement projects around the house.

Save on repairs. The knowledge that tool prices have remained low while outside service charges are soaring, compels a resolve to equip yourself for home maintenance to the extent of your capabilities, an important economy for the hard-pressed homeowner and even a prosperous one.

There are actually hundreds of basic tools, each one in various sizes and types, and a considerable range of quality and prices. Then there are additional hundreds of ingenious tools that were developed to meet special problems, and also each trade field like masonry, electrical, plumbing, radio and TV, auto repair, metal working, etc. has its own catalogues of interesting tools.

Which tools should you own? How do you select them for quality and widest versatility? Where to keep them safe and available?

Basic selections. A practical approach to tool selection must consider the varied needs of the individual. Thus, we have devised classifications and worked out recommended tool assortments for each. These recommendations are not haphazard, but were compiled on the basis of actual experience plus extensive interviews with home-owners and others in widely separated areas.

Select your own category from the chart, then study the recommendations given. Also, look through the descriptions of other tools so that you become familiar with their functions and can add some of those to your collection when the need arises.

Workshop check lists. The following check lists will help you build your tool chest in an orderly way. Each category shows the basic essential requirements and you would do well to get them together at one time, but it could be done "as you go," adding the various items as the need arises. No doubt, you'll find that some tools not on the lists will be acquired because of your own special requirements or interests. Some people go in for appliance repair, others like jewelry repairs or model making, but the guide holds true for the average.

Judging quality. Any experienced mechanic or craftsman will confirm that quality is the buy-word for tools. A well-made tool enables you to get best results from your work, is safer to use, and lasts longer.

For example, a carpenter's saw should be made from steel having the desired flexibility and resilience, hardened and tempered to hold the set of the teeth and resist wear. The steel must be taper-ground, and sufficiently polished for both brightness and smoothness, the handle designed for comfortable grip and tightly secured. Any Disston saw will meet these requirements. Bargain saws are punched from blanks of indifferent steel, without any further tempering.

Chisel and plane blades must be forged and properly tempered to hold their cutting edge. Files made by Nicholson are engineered for efficient cutting, and carefully hardened to function long after cheaper files are consigned to the junk pile. Screwdrivers look simple enough, yet there are "built-in" qualities that separate the good and the bad products by miles.

You can buy a six-foot folding rule for 79 cents, 95 cents, $1.65 and up to $3. Which should you take? They all look pretty good when new, all of them may be quite accurate in dimensions. However, there are important differences. For one thing, the calibrations on some cheap rules are so poorly printed that they soon wear off. Another fault is poor design or con-

struction of the folding joints, which fail to hold the rule straight when open, and break easily so that the rule becomes worthless.

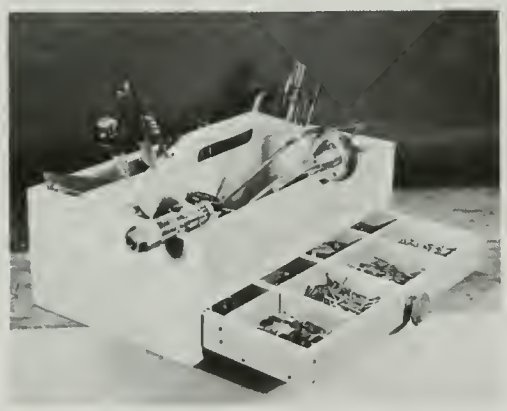
Standard brands like Stanley and Evens assure readability, color contrast, and a plastic finish that protects the markings.

With rules, as with most other tools, there are "features" which may add to the cost. An example is the extension slide, which is a brass bar eight inches long, calibrated for measuring inside area where the folding ruler cannot be opened another stick. The slide shows the additional space which is added to the dimension of the open rule.

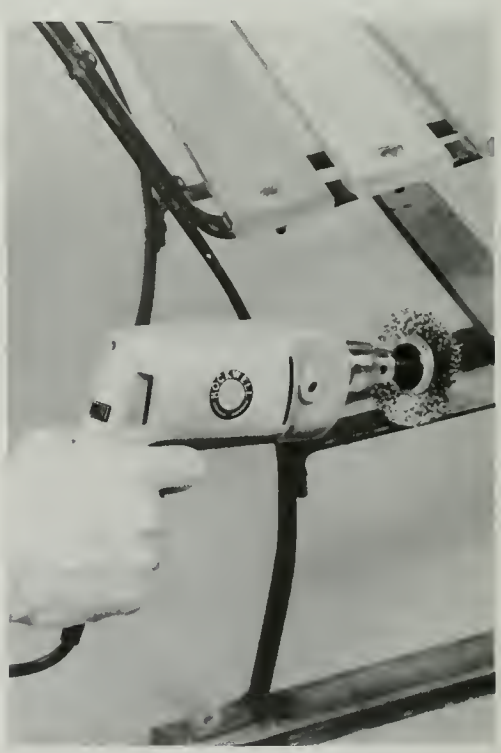
The essence of quality would be dramatically emphasized if you bought some of the packaged foreign tools at some discount and variety store—and unfortunately, now also coming on racks in some previously quality-stocked hardware stores. A set of eight highspeed drills from one foreign country is sold for $1 (some American-made drills are $1 each), but each drill will either bend or burn out in seconds. A couple of sets purchased for testing burned out immediately when used on a soft brass plate, while the smaller sizes bent under slight pressure while drilling a piece of oak.

This experience was repeated when testing tools from several other countries. Wood chisels easily nicked, a block plane could not hold its blade in position, the cutting edge broke on several auger bits.

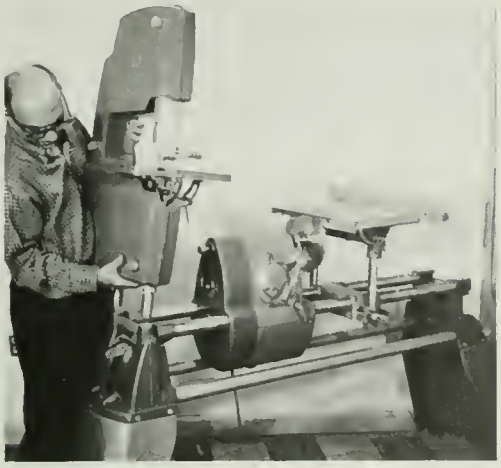
Unless you're prepared to test out various tools in actual use to determine quality (and you would do that only if you planned to buy a large supply of each type), the safest way to select your home workshop tools is to stick to well-regarded brand products. Also, lean to the higher-grade or at least medium-price range, as some manufacturers now also put out lower-quality items to compete with the influx of foreign products.



A classic tool carrier like this is not difficult to make. For convenience, make several and organize your tools in them by function—carpentry, plumbing, electrical repairs, etc.

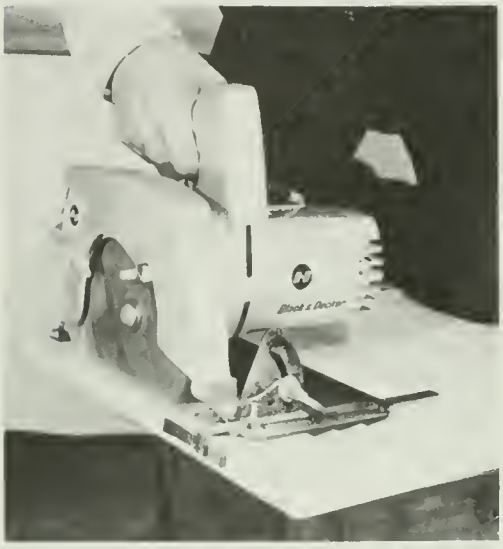


An electric drill can perform a variety of jobs. If you plan to acquire powered hand tools, this is the place to start.



This combination workshop power tool combines a variety of functions—saw, lathe, bandsaw, drill press—within a limited space.

If you are going to do a lot of sawing, a portable circular saw is a labor saver, and it can be carried from job to job.



Quality selection of power tools, whether portable or stationary, is even more critical. A cheap electric drill has limited capacity, will burn out quickly. Cost of repair, often the same as for an expensive tool, would not be justified and thus the entire tool becomes a total loss.

More than that, insufficient motor power can be hazardous, for example with a portable circular saw which balks and kicks back because it lacks power to go through the work. A good portable saw will have sufficient heft to keep the saw steady, a large enough shoe so it can be guided accurately, and a dependable switch.

In electric drills, the points to watch are motor ampere rating, size and type of chuck, and non-load speed. Actually, the more expensive drills are geared down for slower speed. A valuable new development is the variable-speed control on several types of tools.

Of stationary tools, the bench saw is the more frequent purchase. Generally, a large table is essential for safety, wider range of work, greater versatility. A self-aligning fence, an accurately milled, solidly cast table, vernier adjustment gauges, tilting mandrel and efficient power chain are essential details.

Renting tools. One of the things that makes possible a more selective home workshop assortment is that you can rent almost any kind of tool, whenever you need it, at a moderate fee.

Suppose you have to climb to the roof to batten down a chimney flashing. This might require a 40-foot ladder, something that is hardly worth owning because of its cost, large space needed for storage, difficulty of handling.

It's so much better to rent the ladder for a day, get the job over with, and send it back so it's off your hands. The rental for an aluminum 40-foot in most areas runs less than $5 a day—while the purchase price could be around $50 to $60 for something that you might use perhaps once a year. If you do need a ladder for occasional use like cleaning roof gutters or painting trim, it might be better to have a 16 or 18

footer, then rent the additional extension section whenever you might have to climb all the way to the peak.

Even a small tool like a $\frac{9}{16}$-inch staple tacker, which is much more costly than the ordinary stapling gun, can be rented by the day for the infrequent times it would be useful.

Other tools in common demand at rental shops are floor sanders and edgers, wheelbarrows, cement mixing troughs, pneumatic hammers, routers, conduit-bending hickeys, electric planes, ceramic tile cutters and various jigs.

You'll be doing yourself a favor by stopping in at a well-stocked rental dealer to look over the items—just to see what's available when you want it.

Storing tools. Keep tools always in the same place. They will then be found instantly when needed and any missing tool, perhaps loaned to a neighbor, will be spotted. Plan the arrangement to take up minimum space and to protect the tools from needless damage. The best place is on a wall over the workbench with individual holders or brackets for each tool. You can do this most easily with perforated Pegboard wall panel, for which there are dozens of special wire fittings, including brackets to hold small shelves for planes, which should be placed always on their side to protect the blade edge. The Pegboard hangers come in loops, and other shapes to receive screwdrivers, chisels, pliers, levels, hammers and other items.

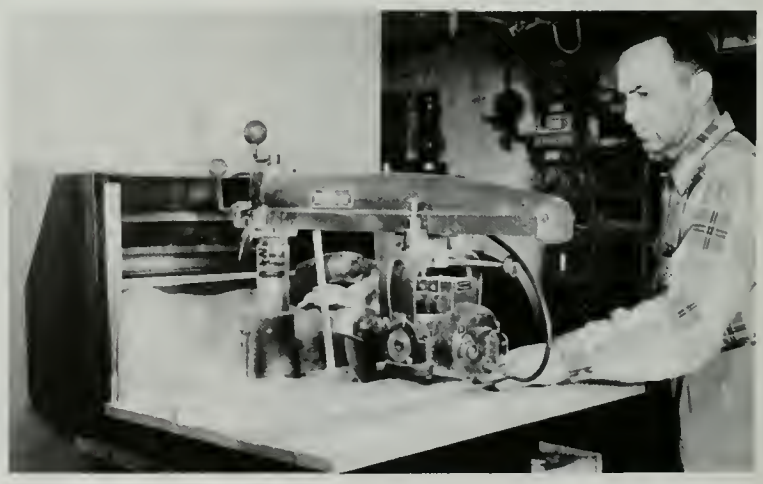
Chisels and files should have individual hangers and not be kept in drawers where the hardened steel would be chipped when another tool is tossed on top.

Auger bits can be kept in a long wood block, with a series of drilled holes to hold the bits in a procession of sizes so you can pick the right one automatically. Add small holes for center punches, countersets, picks and drift pins. Similarly, a single wood block can hold all your Allen wrenches, another block a set of wing drills.

Pipe clamps often are troublesome in storage, taking up considerable space and becoming entangled when placed against the wall.

If you have the space, put two parallel lengths of 2x4s on a wall about 2 feet apart, with cup-like spring clips so that each pipe clamp is held separately, off the floor. If you lack extra space, and use these clamps only occasionally, the best way is to remove the clamp heads and slip off the caps, so the pipes can be tied into a bundle and the clamp parts stored in a box or drawer.

Small instruments and tools, like cal-



➤ *For a workshop installation, choose an ordinary circular table saw or a radial arm saw like this one.*

ipers, triangles, glass cutters, etc. are best kept in their original boxes in a drawer.

Another storage problem for some workshops is dampness, which rusts and corrodes fine tools. Where the condition is mild, a dehumidifier or even just a sack of copper sulphate crystals will keep the place sufficiently dry. Extreme conditions may require extra attention to avoid damage. Hand saws can be protected by keeping them in special damp-proof wrappers.

Milled steel surfaces, such as bench saw and drill press tables, vises, shears, hatchets, some wrenches and squares, can be protected with a thin coating of machine oil. One caution, before feeding wood stock into the saw, wipe off the oil coating from the blade with a solvent to avoid staining the wood. When the job is completed, be sure to restore the protective coating.

Watch for clearance. Power tools in a shop should be arranged for sufficient clearance to handle the stock, and so that one machine does not stand in the way of another. For example, if you're running an 8-foot board through a bench saw, you'll need a minimum clearance of 17 feet at the saw—at least 8 feet in front of the blade, 8 feet at the rear when the work comes through, and the space occupied by the raised blade itself, plus, of course, enough room for you to stand while feeding the stock. This would be a close squeeze even with a narrow board, but if you were to rip a 4-foot wide plywood panel you would need at least another foot clearance to get behind the panel. A suggestion is to locate your workbench, or another tool such as the table of a radial saw or drill press, at the same height as the bench saw to act as a support for the long end of the work as it comes through.

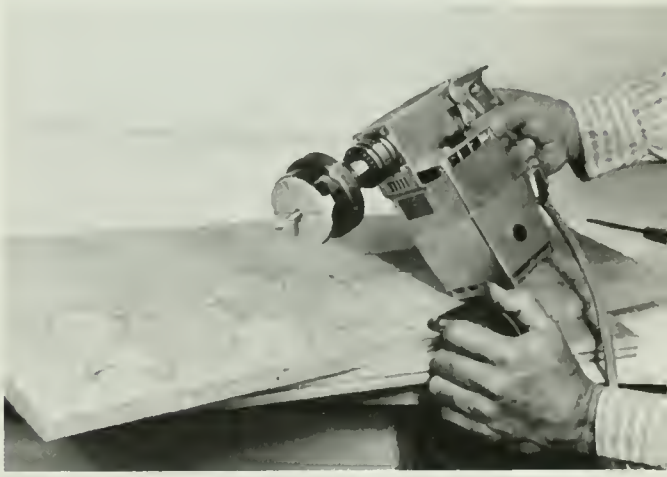
For the workshop with limited space, a good suggestion is to equip tool bases with locking-type casters so they can be moved around for maximum space utilization. In the case of the bench saw, it can be turned to either side for needed clearance when ripping or cross-cutting long work.

Specialized kits. One of the most effective additions to a homeworkshop is a tool carrier, so that when you have to do a chore anywhere in the house you can carry along all the tools and materials at one time. The carrier might have a partitioned drawer or small box containing many sizes of nails, screws, nuts and other things you might need without going back and forth a dozen times.

Taking this a step further for greater efficiency, you might set up several carriers, or tool boxes, each containing the complete assortment needed for any particular type of job. For example, if you have to fix a faucet, take the plumbing box which will have open end and Stillson wrenches, slip-joint channel lock pliers with toothed and smooth jaws (the latter for turning cap nuts without damaging the chrome finish). Also, the carrier will have your assortment of faucet washers, graphite packing and other supplies all in one place.

Similarly, for electrical work, a separate toolbox can contain your linesman's pliers, hacksaw, wire stripper, assortment of

The versatile electric drill with a hole cutter mounted in its chuck.



screwdrivers, threading and tapping dies, together with the supply of wire nuts, connectors, and splicing tapes.

This duplication of tools in boxes for different work won't add much to your basic workshop investment. All it really means is having some extra pliers and screwdrivers—the other items will be part of your regular assortment, only kept in special places for quick access.

Lending and borrowing. If you're in the habit of borrowing tools, or have neighbors who do the same, keep a little notebook handy and jot down whenever you let out a tool so you'll know where it is when you want it—and also know how long it's been away. It'll help prevent arguments on the block. Also, it's a good idea to punch your name or initials on all your tools so there's no chance of an argument as to whether it's yours.

Two portable power tools that are important for many jobs, a saber saw (above), and a router. Shape, edge and trim with router.

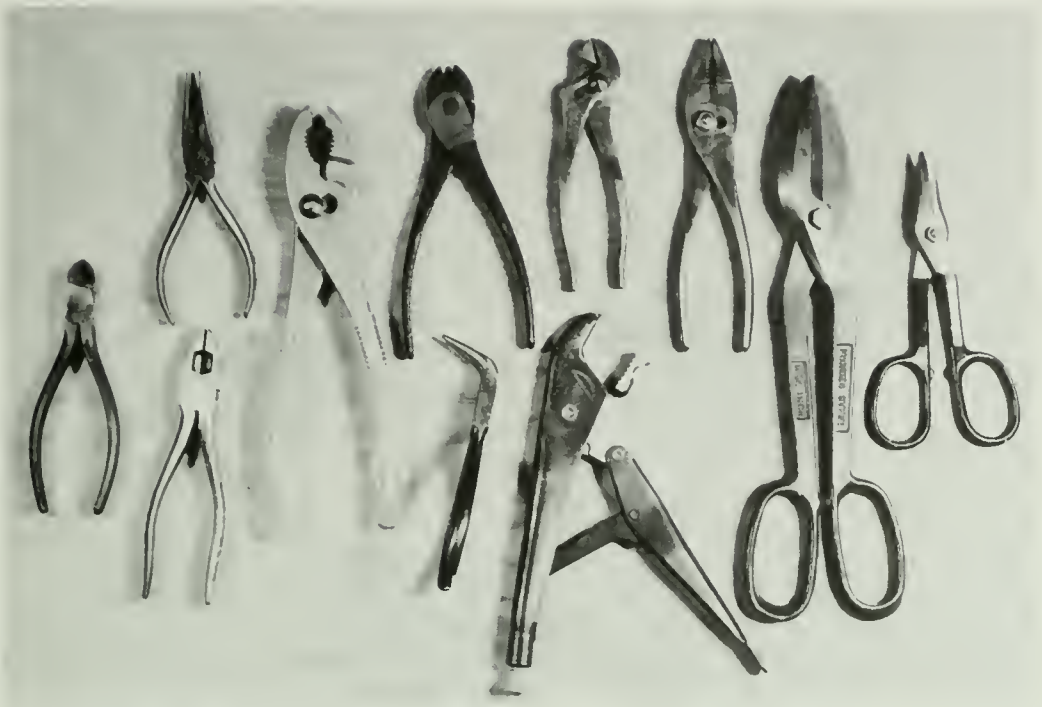
Combination tools. The trend towards combination tools has accelerated steadily. Not only does the combination tool mean less outlay, it also saves storage and allows the homeowner a wider range of work than he would have otherwise.

The Shopsmith is an outstanding example of versatility, performing satisfactorily as a bench saw with exceptional size capacity, a drill press, wood lathe, borer. Setup changes are made quickly with a minimum of effort.

The most recent, and remarkable development in combination tools is General Electric's triple play. This consists of a separate power unit that runs a ¼-inch or ⅜-inch drill, a saber saw, and a sander.

The tools may be purchased one at a time to build up the complete set. Start with the power unit and any one of the units you need at once, then add the two others as you go, together with the practical metal carrying case.

The biggest point to watch in any combination tool offer is that the changeover from one unit to another can be done quickly, without tiresome preparations and assembly. General Electric hit the jackpot with this one, as changeover takes less than a minute—all you do is loosen three screws



A sample of the variety of tools available to the home craftsman to snip or grip with.

in the power head (the screws remain there, can't be lost) separate the ⅓ h.p. power head and slip the splined drive onto the new unit. Tighten the three specially hardened screws and you're ready to go. It's that simple.

Both drill sizes come with Jacobs geared chuck. The ¼-inch drill has a no-load speed of 800 rpm, the ⅜-inch drill is geared down to 900 rpm, making it perfect for drilling masonry with carbide bits and for drilling heavier metal, which requires slower speeds to save the bits.

The saber saw has interesting features. Blades are easily attached by tightening a single set screw, and can be put in either of three positions, facing front or to either side which permits cutting to within ¼-inch of a wall. Tilt table in either direction permits angle cuts up to 45 degrees. Ripping and circle guide included.

The orbital sander, as with the saber saw, has permanently lubricated bronze bearings. The sand pad covers a 33-square-inch area.

In addition to the 3-unit power workshop, General Electric is producing a 7-inch circular saw powered by a 1⅓ h.p. motor, which can cut 2x4s at a 45-degree angle in less than a minute. Total saw weighs a comfortable 10 pounds. A slip-clutch provides a safety factor.

Other tool manufacturers also offer interesting and practical tool combinations with similar separate power units.

Don't pinch on pliers. Any pliers will do in a pinch, but having the right one for the job is smarter.

Many homeowners haven't gotten beyond that old standby—the dime store gas pliers. And it should be said right here that there's nothing wrong with it. In fact, the old slip-joint gas pliers still handles most of the ordinary everyday work, and does it fine. But we're not living in an ordinary

everyday world. Just try reaching into an audio chassis with it to hold a wire for soldering, and see what happens. Or try repairing the catch on a string of pearls. The point is—a gas pliers has no point.

Pliers really boil down to a few family types, with some interesting individual variations. There's the long-nose, with side cutters, and an important variant here is the "bent-nose" very helpful in certain quarters! There's the diagonal cutter that's ideal for clipping cotter pins, baling wire and such jobs. The linesman's pliers is a standard for all electrical work, and the parallel head slip-joint (with both toothed and smooth jaws as mentioned previously) like the channellock, with long handles for a powerful grip that functions like an adjustable wrench.

Prices are low enough for you to assemble a basic assortment consisting of a pair each of gas pliers, needlenose, diagonals, linesman's or insulation skinner type, and the parallel slip-joint.

Choosing hand saws. One good carpenter's saw, a back saw, a hacksaw, and a coping saw should set you up for almost anything you might have to do. A small dovetail saw and a keyhole saw will round out a full complement for the real craftsman.

The carpenter's saw should be the cross-cut type, unless you're likely to do considerable sawing and have no power tools, in which case a rip saw also would be helpful. What's the difference between them?

Rip saws have 5½ teeth to the inch, the teeth set closely and only 8 degrees from the perpendicular on the front, 52 degrees at the back, so that the teeth are faced almost square ahead like rows of chisels, each one chipping off a bit of wood as the saw moves along the grain.

In the cross-cut saw, there are from 8 to 12 teeth per inch, set more sharply and pointed so that rows of the teeth cut the grain fibers like knives, while the wide set forms a kerf to let the saw bite deeper. For ordinary work a 7- or 8-point cross-cut saw is recommended, though cutting of dry, well-seasoned lumber will go quicker with a 10- or 11-tooth saw.

Both cross-cut and rip saws are usually purchased in the 26-inch length. For some work, a short 20-inch saw would be more convenient. Saws should be wiped with a light oil for rust protection unless stored in a moisture-proof cabinet. Avoid finger marks which also tend to cause rust spots.

Back saws have a channel plate across the top for stiffening, come in 10- to 16-inch lengths, 13 points to the inch. Miter box saws are similar but longer, 26 or 28 inches, and have 11 points to the inch.

Keyhole saws are tapered almost to a point, often come in sets of three sizes. They are tempered for cutting thin metals and lead pipe, fretwork and similar inside cuts. They should not be used on gypsum board which requires the harder steel of hacksaw blades.

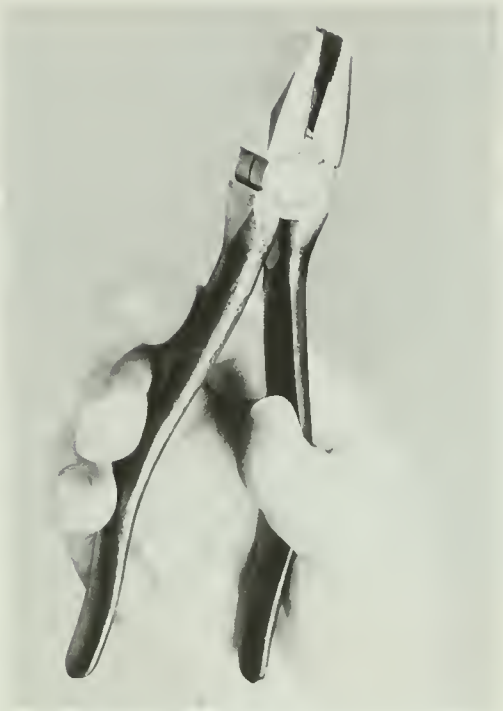
Coping saws are used for curves, shaping the ends of moldings to fit into corners, and making inside cuts for which the blade end can be inserted first into a drilled hole, then fastened into the handle to make the cut.

Saws must be kept "sharp" to work properly. Some meticulous craftsmen like to set and file saws themselves, and for this they need a jointer (which files down uneven teeth to uniform level), a plunger-type tooth setter, and a filing clamp for sharpening.

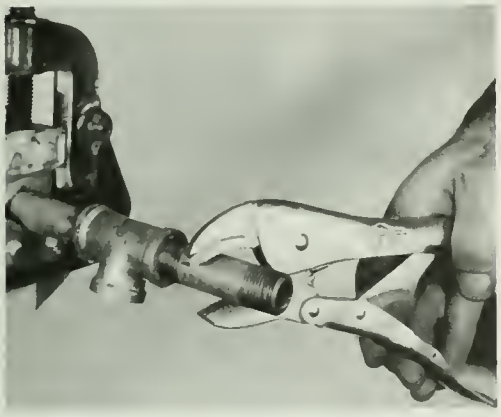
Hacksaw frames take blades of 8, 10 and 12-inch lengths. A sturdy, easily opened and tensioned frame is required. Most have a wing nut to tension the frame; others have tension levels that work very well and are more convenient.

The essential point is to select the proper blade for the job. Use 14-teeth-per-inch blades for cutting material one inch thick,

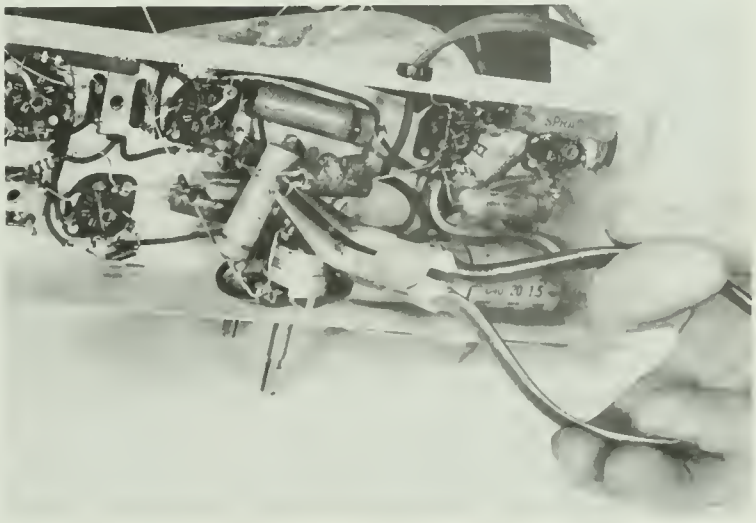
▲ *Nippers can be used to snip wire, pull nails and chip edges of ceramic tile for shaping.*



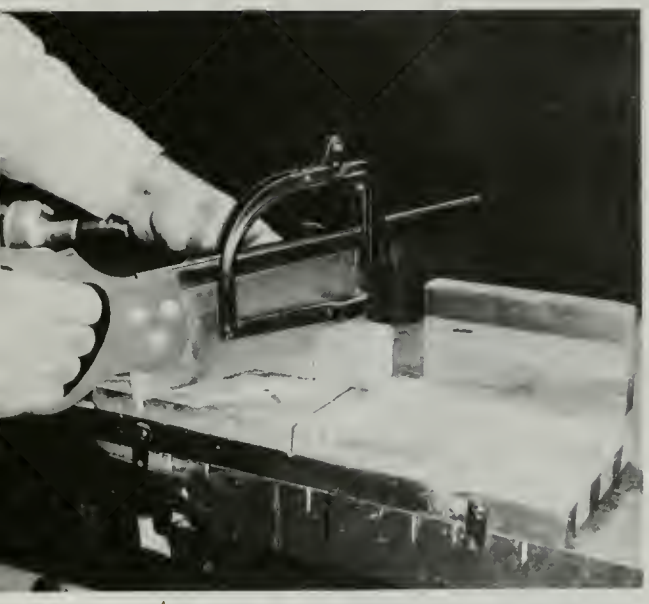
▲ *Linesman's pliers have wide jaw faces, wire-cutting slots, long handles.*



◀ *Lock-jaw pliers grip pipe or other round objects. On flat-sided objects, as bolt heads, jaws can be tightened and locked in position.*



▶ *Bent-nose pliers have long jaws designed to get into hard-to-reach places.*



Use backsaw and miter box to make accurate angled cuts.

This versatile rasp has a sheet of steel grater-like material mounted on a holder. With other holders it can be formed into curves to work curved surfaces.

18 teeth for high-speed steel, aluminum, bronze, ¼-inch to one inch thick. Use 24 teeth for steel and copper from ⅛-inch to ¼-inch thickness; use 32 teeth for cutting any thin metal stock below ⅛-inch. In other words, the thicker the material, the fewer teeth per inch.

Two-man saws. And let's not forget those old buck saws that hung in the woodsheds when homes had a lot more land, fore and aft, than any development house today. Though largely replaced now by the gasoline-driven or electric-powered chain saw, there's many an occasion when a 6-foot cross-cut would come in handy. These saws, lightly arched in shape along the toothed edge, were the pride of Disston's saw works way back when. They're still available in 4 to 6-foot lengths, taper-ground so the back is 2 or 3 gauges thinner than the rest to slide clear in the kerf. One-man models come in 3 to 4½-foot lengths. But don't get one if you're not likely to use it often!

Files and rasps. The most amazing thing about files is their low price, after the painstaking shaping, cutting, annealing, sizing and hardening involved in their production. The two or three files you should own make a very small dent in the budget at a cost of 50 cents to $1 each. An 8-inch mill file and 6-inch round (or rattail) file will service most jobs around the house. If you want to round out the assortment, get a slim taper of 6-inch or 7-inch length, and also a half round which is available from 4- to 16-inch lengths, and in smooth, medium and bastard (coarse) cuts. For very delicate work there are fine, tiny jewelers' files in a dozen shapes. Get a file card and brush, too, to clean clogged gullets and keep the files in perfect cutting order. Be careful not to drop other tools or metals on a file, as it is quite brittle.

Wood and cabinet rasps come in flat, half-round and round shapes, with coarse or smooth cuts. The precision-cutting of power tools make for less reliance on the use of a rasp for fitting joints, but they do come in handy on occasion.

Scrapers. A cabinet scraper is a simple oblong of thin steel, usually 3x5 inches. An important tool in cabinet and veneer work,

it gives a smoother finish than can be obtained by planing or even sanding. The scraper is honed for a perfectly square edge so that when drawn across a wood surface it trims off fine slivers, cleans off fibers. If you do any furniture building and refinishing, a cabinet scraper will help obtain a better job.

Numerous types of scrapers are made for other specific purposes. Wall scrapers, 3 to 4 inches wide, are used for removing old wallpaper and for spackling plaster surfaces. Similar are putty knives (narrower and much more flexible), and very wide wallboard blades that are excellent for taping gypsum wallboard joints.

Paint scrapers come in every possible form, from razor holders to carbide-edged bars, for that tedious chore of cleaning old surfaces. There's no recommendation here, you'll no doubt try several to find one that comes closest to suiting you.

A variety of files. In the center is a wood rasp. Flat files are at left, round and triangular files at right.

Drills. Somehow, the nomenclature on drills left something out. The word drill means both the cutting instrument that forms the hole, and also the tool that provides the power.

Thus, you have the hand drills (often referred to as eggbeaters) and the electric drills. Also the drills themselves which may be twist drills, or wing drills with a pointed screw that starts the hole. In a separate category, but serving the same purpose, are the old-time brace and auger bits.

The hand drill has largely been replaced by the electric drill except for the very small-diameter holes in jewelry and model work. But the brace is still a standby because it can handle auger bits up to 1¼-inch size and make even larger holes with expansive cutters.

With either the hand or electric drill, you should have an assortment of twist drills. For woodworking, a set of carbon steel drills from ⅛- to ¼-inch will suffice. For more exacting work, particularly if you have a drill press, a more complete assort-

ment of high-speed drill sizes to ½-inch will be desirable. A drill box, of the size equal to your assortment, is necessary to keep the drills in order of their sizes and protect them from damage.

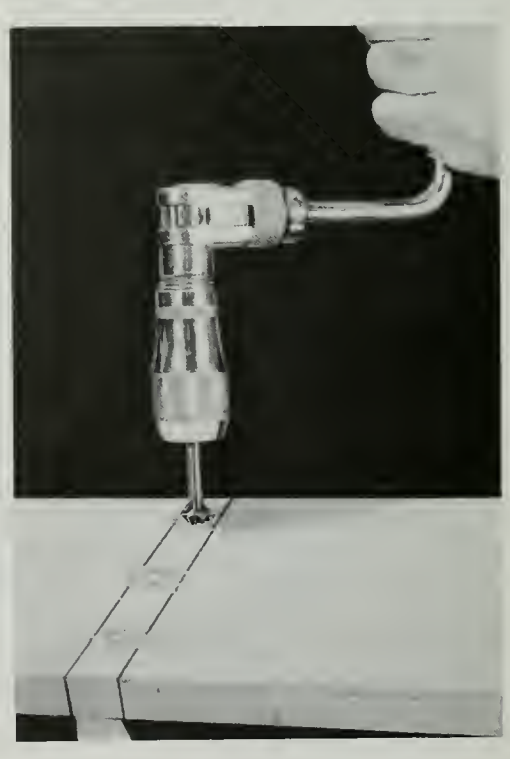
Shaping irregular work with a rasp.

A brace with the basic six sizes of bits is a standard item for any shop from the most elementary to the craftsman's den. Be sure the brace has an efficient alligator-type chuck, and reversible ratchet. A ball-bearing head is useful only when extensive work may be undertaken.

There are extra-long drills, 10- and 12-inch length for drilling right through a wall or floor, and extension rods to go even deeper, excellent for stringing bell and annunciator wires, or for connecting audio speakers around the house. A push drill is a handy small unit that stores its bit inside the head cap, for small work like drilling pilot holes in cabinets for hinges and locks. There is also a screwdriver blade that can be used with the drill and don't miss the great pilot hole drills that form a countersink recess in one operation.

Masonry drills. Percussion and rotary tools are the two means of drilling brick, plaster or concrete for masonry fasteners.

Removing burrs and smoothing edges of cutouts in a brass plate.



Using a countersink bit with a brace to cut recesses for screw heads.

Percussion tools consist of the star drill and the spiral drill. These are shaped and hardened, used with a rubber-capped handle. Repeated sharp taps with a heavy hammer will quickly bore into even hard concrete.

A helpful improvement on this system is Rawl's drill-hammer attachment, used in an ordinary ¼-inch electric drill. The spring-actuated action sounds like a muted machine-gun, but does the job in seconds without effort and permits better control of drilling.

With an electric drill, use carbide-tipped drills of the exact sizes specified with the various masonry anchors.

Levels and plumb bobs. A good many jobs you do around the house will call for the use of a level. Examples are putting up shelves, attaching any kind of wall brackets, setting up a washing machine or dryer, wall framing and masonry work. Less often used, but just as necessary is the primitive plumb bob.

What makes a level function? A short glass tube or vial filled with a non-freezing fluid is sealed at both ends, leaving just a small air bubble inside. The tube is set into a perfectly straight holder of either wood or aluminum. The glass tubing is marked with cross lines; when the bubble is exactly between these lines, the work is level.

A "proved glass" level has a tubing that is slightly curved for a high center position for the bubble. A "ground" glass is straight, but the inside barrel is shaped to form a high point at the center.

Levels are made of seasoned wood, aluminum, or steel. Some types have two and as many as six vials, so they may be viewed accurately from any position, and will continue to function even if one or two vials are broken. Vials placed across the ends serve for plumbing a wall, making two tools in one.

Some professional-type multi-vial levels are adjustable to any angle or degree of

Spirit level (see text) and plumb bob are essential for keeping work straight and true.

pitch per foot, very handy for masonry work and other jobs.

Levels come in many lengths, 4 inches to 6 feet. Use the longest level convenient on any work for accuracy and easy sighting.

Line levels are small metal tubes with catches that grip a string or line which is held taut, to determine grades and pitch in foundation, slab and brick work. Other interesting types are camera levels, pocket-size torpedo levels, and level-sights to obtain a straight run of fencing and walls.

The average home shop should have a wood or aluminum carpenter's level 18-inches long, and perhaps a pocket-size one.

Any simple plumb bob will serve average needs. A 5- or 8-ounce pointed bob costs very little.

Screwdrivers. Probably no other tool is as simple in its concept, yet so important, as a screwdriver. Just a metal shaft, flattened and filed square at one end, a handle on the other end.

Yet a lot goes into making the screwdriver as dependable and long-lasting as it is. The bar must be strong enough to withstand strains and remain perfectly straight —a bent screwdriver is worthless. The blade must be correctly tapered, forged and tempered so it won't chip at the corners, the tip ground square to hold in the screw slot. Handles may be wood, rubber or plastic, shaped for a good and comfortable grip and securely fastened to the bar. A screwdriver with a loose handle should be discarded before it causes a painful injury.

Simple as it is in design, there are probably as many varieties of screwdrivers as any other tool. First comes the range of sizes, from the tiniest jewelers precision drivers to massive square bars that can be given extra torque with an open end wrench.

There are long and thin drivers for radio work, short and thin drivers for accurate turning of the oval screws in cabinet hinges.

Wood chisels come in widths up to 1-1/2 inches in 1/4-inch steps.

Smoothing and trimming an irregular shape with a spoke shave.

Spoon chisel lifts splinter for invisible nailing. Nail is driven through molding beneath splinter. Then, splinter is glued back in place over nailhead.

"Stubby" screwdrivers come less than three inches overall to fit close quarters, while offset screwdrivers work in even more difficult locations.

There are ratchet drivers of many types including a spring-action, push-type driver. If you're looking for speed when there are a lot of screws to turn (building a small boat takes hundreds of screws), you can use a clutch-type driver as an accessory with your electric drill.

There are also screwdriver bits that fit into a drill brace, and into offset ratchet drivers that need only an inch or so of clearance. A popular novelty item is a "combination" hollow tool holding a half-dozen and more screwdrivers of progressively smaller sizes, each fitting into the other.

In recent years, the Phillips cross-slot screws have become more widely used, requiring that you have at least two of these drivers.

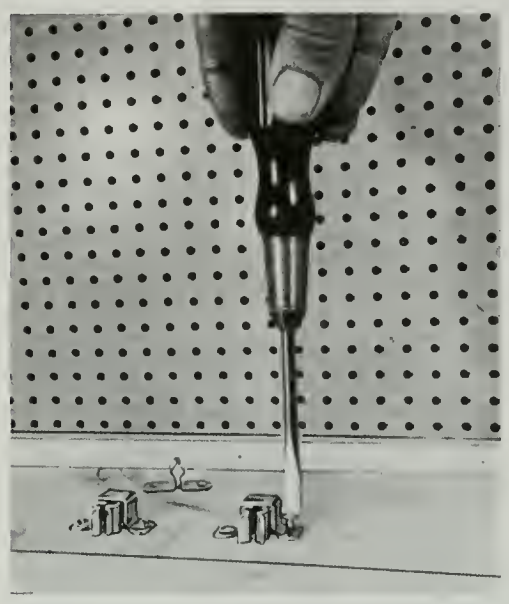
Screwdrivers are used so frequently around the home that a goodly supply is needed so they can be kept in several places, in addition to the workbench supply.

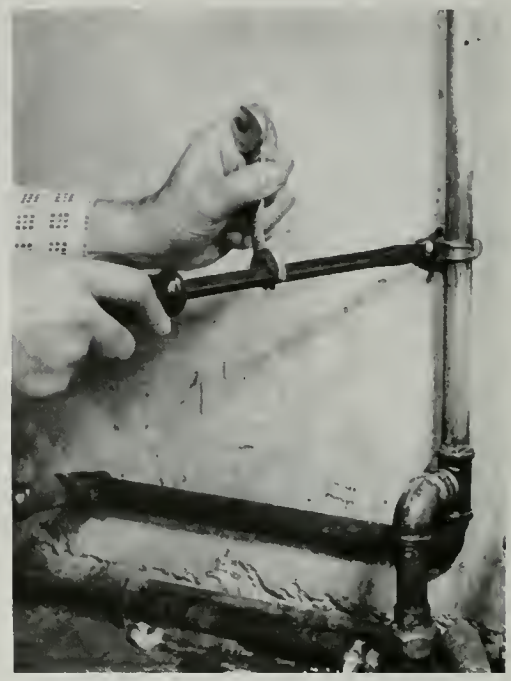
Chisels. Chisels are an essential component of every toolbox. They are used for

Leveling a board with a smoothing plane.

cutting mortises, squaring drilled sections, scraping dado grooves, tapering and fitting cabinet joints, recessing door latch plates and other jobs.

In addition to the standard flat type, which comes in blade widths up to 1½ inches in ¼-inch steps, there are wood-





To prevent burring of the screw slot, always choose a screw driver the correct size for the screw—whether using an ordinary screw driver (left), a hefty one with a square shank . . .

. . . or one with a screw holding spring clip.

carving chisels of many shapes, wide-blade glazier's chisels that make quicker work of cleaning out old putty (and are strong enough for use to ease up stuck windows) and even wider floor chisels beveled on both sides of the tip to cut through the tongues in flooring boards. Another group is known as turning chisels for use with a wood lathe to cut roundwork.

Cold chisels are specially tempered for cutting brick, cement blocks, other hard surfaces, come in a wide assortment of lengths and blade widths. Machinists chisels come in handy on many metal-working and auto repair jobs—an example is splitting a rusted stud nut that can't be turned. Available in many sizes.

Planes. The main types of planes are:

Block plane, for cutting across the grain; blade adjusts at ends, sides, throat. About 7 inches long.

Smooth plane cuts along the grain, obtains a very smooth surface, runs about 7 to 10 inches long.

Jointer or fore plane, 18 to 24 inches, for long work such as the edge of a board. Length aids obtaining level surface.

Modelmaker's plane is short, about 3½ inches, has 1-inch wide blade.

Rabbet plane has open sides, so blade cuts right up to the edge for weatherstripping work, and to cut notches, rabbets, grooves. Plane has adjustable fence for controlling width of cut.

Circular plane has rounded bottom, adjustable to cut concave and convex surfaces. Blades can be tilted in either direction.

Scrub plane cuts fast to remove quantity of wood, for leveling surfaces, trimming boards to size. Not for smoothing.

Beading plane takes a large assortment of shaped cutters to form picture frame and decorative moldings and similar purposes.

For the average workshop, a pair of bench planes consisting of a block and smoother plane will do for around-the-house purposes. Any of the other types are worth getting when needed for a particular job.

Spoke shaves are in the category of planes. They are held in both hands by the side handles, and pulled along the work, rather than pushed as is a plane.

Wrenches. There are so many types of wrenches they've almost run out of terms for describing them—and no doubt new ones will come along to cope with old problems and handle the new types of hardware.

Following are the most commonly used types with suggestions for your personal assortment.

Adjustable (including monkey wrenches), from light to heavy weights, with side, end and offset jaws. Can be fitted to any size nut or cap up to 2 inches. Because the fit is not exact, adjustable wrenches may slip and round off the nut. Better-quality adjustables with closely-matched gears do the better job.

Open-end wrenches with a different size at each end, in every possible size for exact match. The ⅜-, ½-, $\frac{9}{16}$- and ¾-inch are basic sizes, should be in every tool chest.

Socket wrenches and box wrenches give assured grip, are essential for auto and machinist work. Sets available for various purposes. Some socket wrenches are fitted with handles; others are used with separate ratchet handles, cross-bars, speedy brace, and other devices for meeting difficult conditions.

Deep sockets, used for certain in-the-wall faucets and for auto spark plugs.

Stillson (pipe) wrenches have spring-tension jaw, deep notches to grip rounded surfaces. Essential for plumbing work. Own a large (14-inch) and small (8-inch) one.

Basin wrench has long bar to fit up behind wall basins, with swivel jaw, cross-bar at bottom for turning.

Wide-mouth locknut wrench opens to 3 inches, for slip nuts on sink, traps, etc.

Socket chain wrench grips hex nuts and round surfaces, self-adjusting to any opening. Has long pull handle. Snap wrench serves the same purpose, but has smooth surface to avoid damaging chromed fixtures.

Allen wrench fits internal hex openings as in set screws. All sizes to ¾-inch available.

Pipe and tube cutters. Pipe and conduit cutters have alloy steel cutting wheel which revolves around the pipe, cutting gradually as threaded handle is tightened. Does neat job, quickly, though cutter burrs inside of pipe.

The smaller copper tubing cutter clamps around the work, has a thin cutting wheel that goes through without distorting the tubing.

Pipe also can be cut with a hacksaw, but the ends will not be square across.

Hammers. A good-quality carpenter's claw hammer is so versatile that it will do 95% of the hammer work around the house. However, for easier and more efficient work, you might want to get several special-purpose hammers.

Claw hammer, the basic type, recommended size, 16 ounce head, 13-inch length, and of good standard make which is properly tempered, perfectly balanced, with selected and well-fitted hickory handle.

Machinist hammer in the 8- or 12-ounce weight, has round peen head.

Plastic, wood or rubber mallets for caulking boats, forming soft metals, jointing cabinets and similar work where a resilient head is desirable to avoid marring surfaces.

Bricklayer's hammer for aligning brickwork, slate, stones. Has long, tapered head that serves as a lever.

Stone hammers have one beveled and sharpened edge for chipping stone, the other square for tamping.

Sledge with 4-pound head is handy for all kinds of heavy work. Long-handle sledge is fine for breaking sidewalk slabs, splitting logs (with wedges) and similar work.

Tack hammers, also for upholstery work, long and narrow heads, some of magnetic steel for holding tacks.

Auto fender hammers, in dozens of shapes, used with forged backing blocks, or dollies, curved or rounded surface.

Hatchets. Hatchets and axes are in this group too. A small half-hatchet (one cutting edge) will be valuable to homeowners for many tasks, both in the workshop and grounds, to shape stakes, clear small trees, trim framing studs, split fireplace wood. For the camper and hunter, there's a special type. Hatchets are sharp, can be dangerous if left lying around. Set up a special place with a leather holster to protect it. For the rural and suburban dweller, a good axe is still handy around the house.

Squares. A carpenters square is a simple tool with the "built-in" knowledge of a slide rule. Mostly it's used for checking the alignment of work, whether it's a small cabinet or bookshelves, but the square also gives information needed for cutting rafter angles, lengths of braces, board measures, etc. A simple but practical square two-feet long with a one-foot tongue will serve your purpose unless you go in for building a den and other construction jobs, in which case you'd want a carpenter's square.

Trysquares and miter squares are smaller, easier to handle. Some have a true 45-degree fitting at the handle for testing miter joints.

Combination squares have sliding steel blades, plus miter gauge and spirit level. They can be used readily as a depth gauge, marking gauge, miter square, plumb and level, and as a straight edge (by removing the blade).

In the category also are various angle dividers, used mostly by carpenters on building jobs and by cabinetmakers for marking precise angles in fitted work.

Marking gauges are of wood or metal,

have a block-mounted marking pin that slides on a calibrated bar to measure off desired distance. A thumb screw in the block locks it at any position.

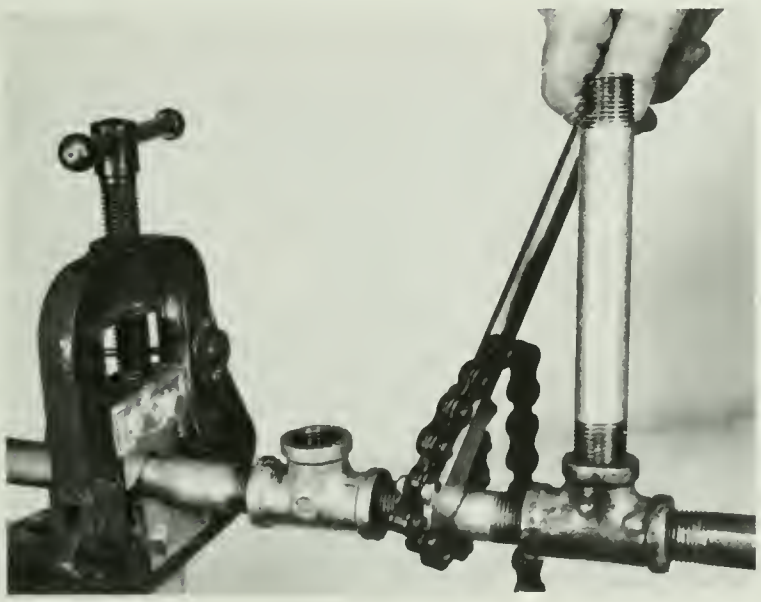
A special tool is a butt gauge used for laying out the hinge mortises on doors and their castings, also positions of latch plates. Assures accurate alignment of hinges, saves time.

A companion tool is the butt marker, like a rectangular chisel. Place the marker on the hinge position and strike it with a hammer. The chisel-like edges cut the outline of the mortise which then can be neatly cleaned out with a chisel.

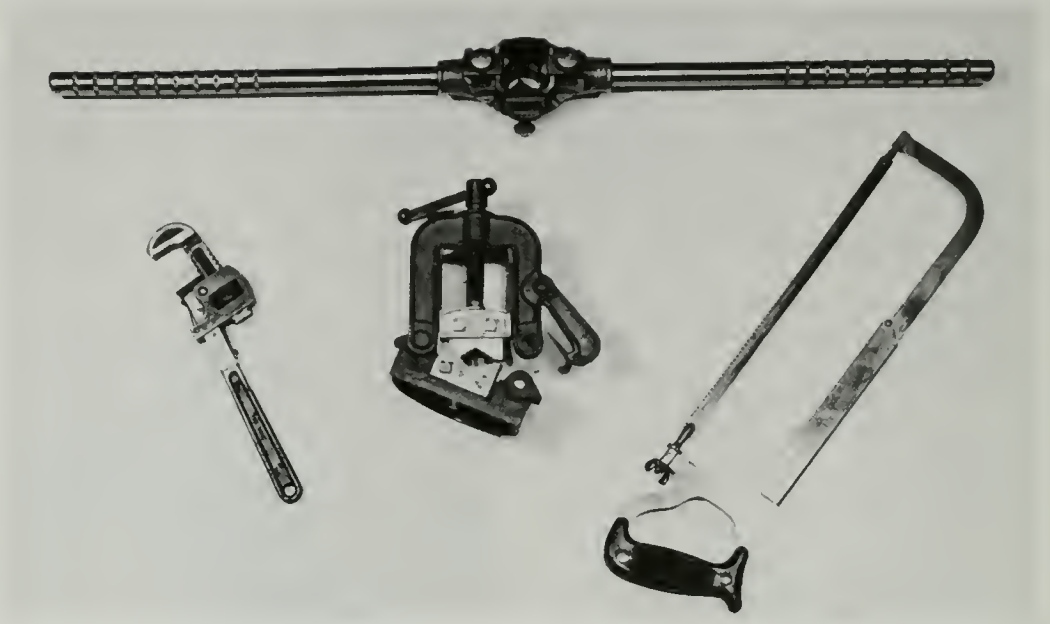
Awls, punches, nailsets. A good-quality scratch awl, similar to an ice pick, is essential in every tool collection from the most elementary to advanced craftsman. It is used to start screw holes, especially for hinge screws (failure to get exact center can force the hinge out of alignment), cup hooks, and similar work. It can mark guide lines on metal for sawing, and is used to spread the center of Rawl fiber masonry plugs before the anchor screw is turned in, and any other work requiring a sharp point.

The awl should be of top quality, properly tapered and tempered.

A center-finder combines the principle of a punch and an awl. It is a metal rod, beveled on one end to fit the countersink of a hinge leaf. The center has a pointed blade, retracted by a spring. When tapped, the blade point enters the center, starting the screw hole in the wood.



Both the Stillson wrench (above) and the chain wrench (left) tighten their grips around pipe, or round or irregular shapes, as pressure is increased.



▲ *Plumbing tools include holder for pipe thread die (top) and (bottom left to right), a Stillson wrench, pipe vise and hacksaw.*

Other center punches are used to locate the precise drill point in metal. Sizes are based on the diameter of the tip. Nailsets range in size from 1/32 to 1/8-inch. Use the size roughly equal to that of the brad head.

Soldering irons and torches. An instantaneous soldering gun is perfect for all radio, electronic, jewelry, electric wiring, and other light work. The Weller gun is justly famous for its dependability, high capacity. Comes with several tips in different shapes for special purposes. The bigger models also have tiny "headlights," an invaluable feature.

For heavy soldering, like copper roof gutters and for brazing, the old-type soldering "iron" that is heated on a gas stove, or a heavy-duty electric iron of over 250 watts is still needed. Small soldering irons with variable tips are used for continuous assembly work.

Propane torches are the thing for plumbing, electrical and dozens of other purposes like thawing frozen pipe. Easy to use, lights up in a second. Flame is adjustable. Complete torch sets include flame spreader, soldering tips, burner hood, paint scraper attachment. Replacement gas cylinders are available.

Gasoline blow torches are used now mostly by professional plumbers and other trades that need a continuous flame. Small alcohol torches are used in many crafts, such as cabinet finishers. Alcohol lamps also are still common, used for melting shellac sticks in furniture repair work, and for hobbyists interested in chemistry, plastic modeling, etc.

Clamps and vises. A decent supply of both pipe and C clamps is a must for your workshop. You can't have too many, for cabinet making, chair repair and other work.

Pipe clamps are vital for gluing. They come with separate cap and jaw faces, are used with a length of 3/4-inch pipe threaded at one end. Old iron pipe, provided it is straight, can be used. The cap is threaded

inside, turns on the pipe threads; the jaw face slips on the other end of the pipe, has a ratchet clutch that slides for quick closing of the clamp. A screw handle in the cap applies pressure.

Bar clamps are complete units, easier to use, dependable. The tail jaw is gripped at notches along the bar. Lengths run to six feet.

C clamp (or carriage clamps) of malleable iron are measured by the throat depth, from 1 to 8 inches.

Handscrews with maple jaws are splendid on wood cabinet jobs, favored by professionals. Sizes to 10-inch jaws, but quite expensive.

Bench clamps attach to a straight and rigid surface such as a workbench top, handle long work conveniently.

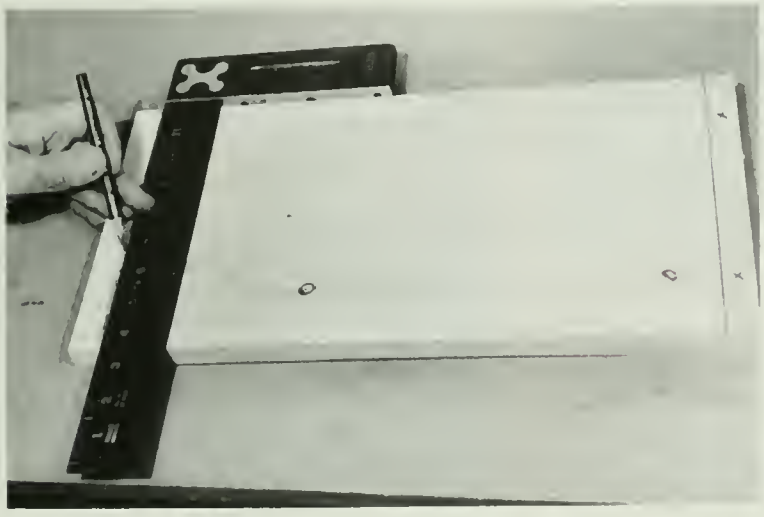
Hinged clamps by Jorgensen are for permanent mounting on workbenches, swing down out of the way when not in use, but always available for setups.

The Jorgensen line also includes special-purpose types like rounded body clamps for clearance around the work, strap clamps that fit any irregularly shaped surface, spring clamps, miter clamps.

If you need any special kind or shape of clamp for a chore, just look around the stores and you're bound to spot one that will do the trick.

Bench vises vary in size and strength. A solidly-built vise with a 3½-inch jaw will do for average use, though a 4¼-inch or even 5-inch opening may be desirable if heavy work is done. Look for features like

▲ *Use a punch to peen hollow rivets.*



◀ *Few woodworking jobs can be completed without the use of a try-square to align, mark and measure.*

Bar clamps come in a variety of lengths.

a swivel base, enabling you to turn the vise to any direction for work clearance or easier access, replaceable steel jaw faces, a pair of pipe jaws under the regular jaws to hold round objects, an anvil and horn for hammering and shaping metals, and a hefty handle.

A woodworker's vise is a worthwhile addition to any bench, has large flat jaws that hold boards for planing, sawing, etc.

A portable vise, with attachment clamp, is useful when doing work away from the workshop. Fastens easily to doors, etc.

Drill-press vises come in many types, such as angle vise adjustable to 90 degrees, squared vise, and various work holders with jaws for tapered and irregular shapes. In this category, too, are adjustable hold-downs for locking work in position on the drill-press table.

A small scissors clamp, with finger grips and serrated jaws, holds small parts securely while doing precision assembling, soldering, etc. Tweezers also are in this group, often are of great help when working with small items.

Staplers. A stapling gun is useful for light upholstery work—such as recovering kitchen chairs and attaching slipcovers—and generally outmodes the use of tacks.

The popular-priced models handle staples of $\frac{5}{16}$-inch leg length. More powerful compression models, needed for such work as installing ceiling tiles and other jobs requiring staples of ½-inch to $\frac{9}{16}$-inch leg length, are more expensive.

Masonry tools. Sidewalk repairs, brickwork pointing, concrete patio slabs, flagstone laying, and other masonry jobs are quite routine in the modern home. The tools listed are used for various types of work, but only a few may be necessary for your particular needs.

Brick trowel pointed, is one of the basic masonry tools, used not only for laying bricks but also to apply and fill cement into forms and repair openings.

Patching trowel has 1¾-inch blade, used for plaster as well as cement, has blunt front edge.

Hawk is a sort of tray with handle underneath to hold mortar and plaster for application.

Square trowel of spring steel blade, for

leveling and smoothing concrete or plaster.

Groover cuts ⅜-inch wide groove in sidewalk, panels, stucco walls, etc.

Wood float is used for "working out" and smoothing concrete surface.

Rub brick dresses and smooths tile, marble, concrete. Selection of 60, 80, 120 and 150-grit.

Outside and inside corner tools with handles, for clean squaring of concrete corners.

Brick jointer is a narrower bent steel bar for packing mortar between brick and finishing off the joint.

Tuck pointing trowel, narrow with handle, for brick mortar repairs.

Plumbing tools. Plumbing work ranges all the way from changing a faucet washer —about as simple a little job as you'll have to do around the house—to complex projects like extending a new water line or drain. So the tools you'll keep on hand certainly won't attempt to cover more than the few that let you handle properly the everyday chores plus handling any emergency.

Stillson wrenches. A small Stillson will serve most purposes, but for any pipe work you'll need two wrenches to ease the strain on the lines. Make the second Stillson a really large one that can be used to "break" tight pipe joints. A sprocket chain wrench will do as a substitute.

Gas pliers, large slip-joint channellock without teeth.

Adjustable wrench, side of offset jaws. Also, open end or box wrenches, sizes ½, 5/16, ⅝, 11/16 and ¾ inches.

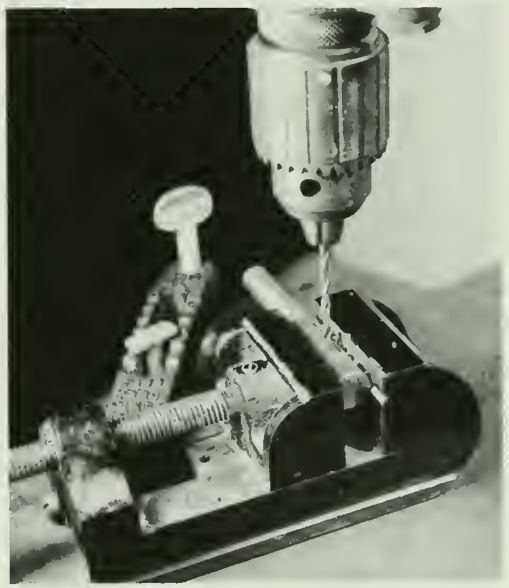
Pipe cutter and reamer, for ½- or ¾-inch pipe (depending on the size in your home).

Pipe threader of required size.

Copper tubing cutter and flaring tool.

Propane torch for sweat soldering of copper tubing.

Special-purpose tools. Hose clamp pliers



▲ *Drill press angle vise is designed to hold almost any stock at any angle for drilling.*

◀ *One of many uses of the blow torch: softening old paint for scraping.*

opens the high-tension spring wire used as hose clamps on cars, washing machines and dishwashers.

Eyelet pliers punches holes in cloth, plastic sheeting, canvas, then crimps grommets or eyelets for tear-proof lacings.

Pop rivet tool, for "blind" riveting when you can't get back up with ordinary peen

TOOLS TO FILL A TOOLBOX OR BASEMENT SHOP

Group 1. Minimum Assortment		
Claw Hammer	6-foot rule or tape	Putty knife
Screwdrivers—small and medium	Small block plane	Scratch awl
Slip pliers		
Group 2. Handy Apartment Tenant		
Screwdrivers—large, small, Phillips	Spirit level and plumb bob	6-foot rule or tape measure
Claw hammer	Wood chisel	Scratch awl
Hand or 1/4" electric drill	Pliers—slip-joint, needle-nose, wire stripper	Putty knife
Coping saw		
Group 3. Homeowner Doing Minimum Maintenance		
All the tools in Group 2	Caulking gun with cartridges	Trysquare
Carpenter's saw	Set of 6 wood chisels	Scraper
Stillson and monkey wrench	Brace and bits	Wall knife
Crowbar or pinch bar		
Group 4. The Ship-Shape Homeowner		
Screwdrivers—full sets including Phillips	Paint brushes	Crowbar or pinch bar
Hammers—claw and tack	Electric sander	Putty knife, wall knife, scrapers
Pliers—slip-joint, needle-nose and wire stripper	Miter box and back saw	Set of deep socket wrenches (spark plug type)
Wrenches—2 Stillsons, adjustable, open end	Trysquare; large square	Stapling gun
Wood chisels—full set	2 Pipe clamps	Caulking gun
Block plane	2 C-clamps	A good workbench with vise
Electric 1/4" drill, set of bits and carbide #10 size	Folding rule and tape	2 Nailsets, center punch
Carpenter's saw, hacksaw, keyhole saw	Plumb bob and spirit level	Ladder
Electric jig saw	Soldering gun	Propane torch
Group 5. The Project Builder		
All the tools in Group 4	Spoke shave	Masonry drills or pneumatic hammer
Bench saw or radial saw	Carpenter's level and line level	Wood vise and machinist's vise
Drill press	Oil stone	Coping saw
6 or 8 pipe clamps and C-clamps	Grindstone and buffing wheel	Ladder
Router	Block plane and jack plane	Cement trowel
Doweling jig	Sledge hammer, hatchet	

Group 6. Craftsman and Hobbyist

Screwdrivers (full sets)	Scratch awl	Band saw or jig saw
Hammers—claw, machinist's, tack and sledge	Center punches, nailsets	Jointer
Carpenter's saw, keyhole saw, hacksaw, dovetail saw	Levels, plumb bob	Portable saber saw
Set of files	Block and jack planes	Electric ⅜" drill
Set of wood chisels	Assortment of clamps	Portable circular saw
2 cold chisels	Doweling jig	Router
Shovels, wheelbarrow	Miter box and back saw	Belt and disc sander
Masonry drills	Scrapers, paint brushes	Portable orbital sander
Trysquare and large square	Wallboard and hooked knives	Router with edge trimmer
Rulers, tapes, calipers	Tinsmith shears	Lathe
Soldering gun	Oil stone	Electric planer
Stapling gun	Grindstone	A good workbench with machinist's vise, plane stops, wood vise
Caulking gun	Bench saw	Ladders
Wrenches—box, open, socket	Radial saw	Propane torch
Pliers—slip, linesman's, needle, diagonal, wire stripper	Drill press	

rivets. Pop tool pulls a hardened, specially shaped pin through the back of the rivet until it is squeezed tight, then snaps off the pin.

Copper tubing benders. Coil springs of exact size slip over tubing, prevent kinking when tube is bent.

Retriever tool. Ever drop a small part deep down in an appliance or car and can't reach it? The pickup tool is a long tube with spring steel fingers that are pushed out and allowed to grasp the part, then retracted to hold it tightly.

Edger for plastic laminates. Adjustable jig with carbide cutter, used with a router, trims overlap edge for perfect corner joint. Used to make self-edged plastic tabletops and kitchen counters. Forms clean, uniform line when two sides join.

Cornering tool is curved metal bar, with beveled, elliptical-shaped holes at each end, used for rounding sharp edges on shelves, furniture, patterns.

Doweling jig clamps on both parts of work, has collars for drilling guide. Single adjustment assures dowel holes will match.

Stencil paint roller made of rubber or plastic with embossed design, gives interesting wallpaper effect right on painted walls. Used with contrasting colors.

Asphalt tile cutter has platform with long bar, cuts tile to exact size like a paper cutter.

Flaring tool shapes end of copper tubing for tight seal in flare-type fitting.

Plank rods for reinforcing timbers, wood planks. Steel rod 10 or 12 inches long has a drill point, is used with centering guide and ordinary electric drill, into side of plank. Projecting end of rod is bent and hammered into the wood. R.T.

See also: CHISELS; DRILL ATTACHMENTS, POWER; DRILL PRESS; JIGS; LATHE; MAINTENANCE, CHAIN SAW; POWER TOOLS; RADIAL ARM SAW; ROUTER; SABER SAW; SANDERS; SAW; TABLE SAW; TOOLS; WORKBENCH; WORKSHOP.

Use a torque wrench to tighten anything you can fit it on, including spark plugs.

How to Tighten Bolts Precisely

Use a torque wrench to get exactly the right tension on nuts and bolts. If fasteners are too loose or too tight, they can damage your work

EVER-INCREASING USE of lighter and softer metal components in automobiles, power mowers, outboard motors, and many household appliances means that homeowners who do their own repairs can no longer rely on hand-tightening nuts and bolts just enough to do the holding job, yet not so tight as to cause damage and premature failure.

Gone are the days when it was permissible to tighten nuts until they squawked or snugged up.

To get the proper clamping and holding force from any fastener demands that just the right amount of tension be placed on the fastener to stretch it to the predetermined amount of elasticity.

Too much tightening force can stretch the fastener past the point from which it can snap back into original shape after being stretched, making it unfit for further use. It will also cause the metal component to warp or twist.

On the other hand, too little tension reduces the fastener's ability as a clamping device. Consequently, that part of the assembly will either loosen, fracture, or fail prematurely. General torque tightening specifications are in the accompanying table.

Function of the torque wrench. Its purpose is to measure the amount of tightening force applied to the fastener. Today's close-tolerance assemblies require pure precision to establish the correct tightening tension.

All torque wrenches are designed on the principle of the lever. Torque is based on the fundamental law of the lever, which states that force times distance equals the torque about a given point. Force refers to

the amount of pull applied to the wrench handle by the operator. Distance is the length of the wrench measured between the centerline of the force being applied to the handle and the centerline of the drive square. To arrive at torque, multiply force times distance.

Most commonly used torque wrenches are the pound/inch and the pound/foot. The occasion often arises when it may become necessary to convert pound/inch into pound/foot, or vice versa. To convert a pound/foot reading on the scale of the wrench to pound/inch multiply the scale reading by 12. To convert pound/inch to pound/foot, merely divide the reading on the pound/foot scale by 12.

Increase capacity of the torque wrench by using an extension or adapter to gain access to hidden fasteners and nearly double the calibrations on the torque scale.

A fitting equal to the lever length of the wrench will multiply the torque by two; thus a 100 pound/foot wrench can be used to tighten bolts up to 200 pound/foot.

Although these fittings enable you to get maximum utility from the wrench, they also increase the length of the wrench and have the overall effect of increasing the length of the lever so the torque scale will not give an accurate torque reading.

By using the illustrated formula, you can see that a 10-inch torque wrench with a four-inch adapter or extension will overtorque by 4 pound/foot even though the scale reads 10 pound/foot.

Using the torque wrench. This is no more difficult than a regular ratchet or pull handle. There is no hard and fast rule as to whether you should push or pull. The only requirement is that you do not twist or bind the handle.

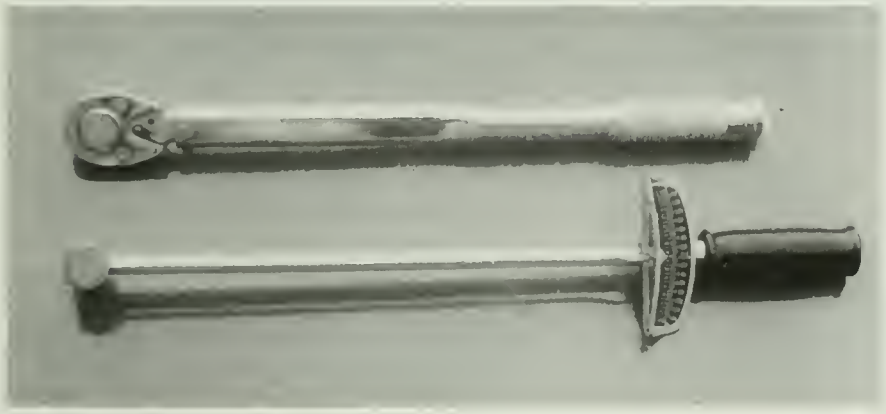
The pivoted handle, or floating handle as it is sometimes called, is so designed that it conveniently fits the operator's hand and concentrates the pulling force at a fixed point on the torque wrench.

When using the wrench, the force should be applied to a specific point rather than spreading it out over the entire area of the handle.

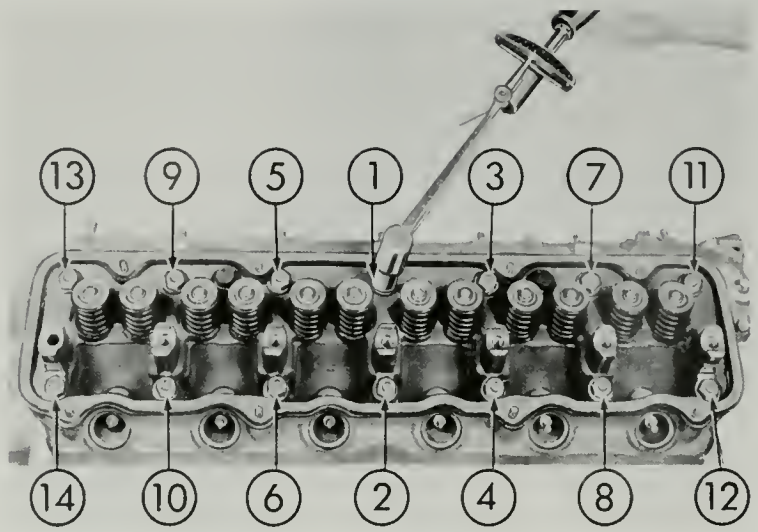
Important points to keep in mind when tightening down threaded fasteners are thread resistance, fastener seizure, and tightening procedure.

Thread resistance is caused by damaged or rusted threads. The rule of thumb to follow when tightening fasteners on such threads is to add the thread resistance to the torque specification for the final torque reading. For instance, if the specification calls for 20 pound/foot torque for a certain nut, and if it takes 3 pound/foot to overcome the thread resistance, tighten the nut to a torque of 23 pound/foot.

To determine just what is the amount of

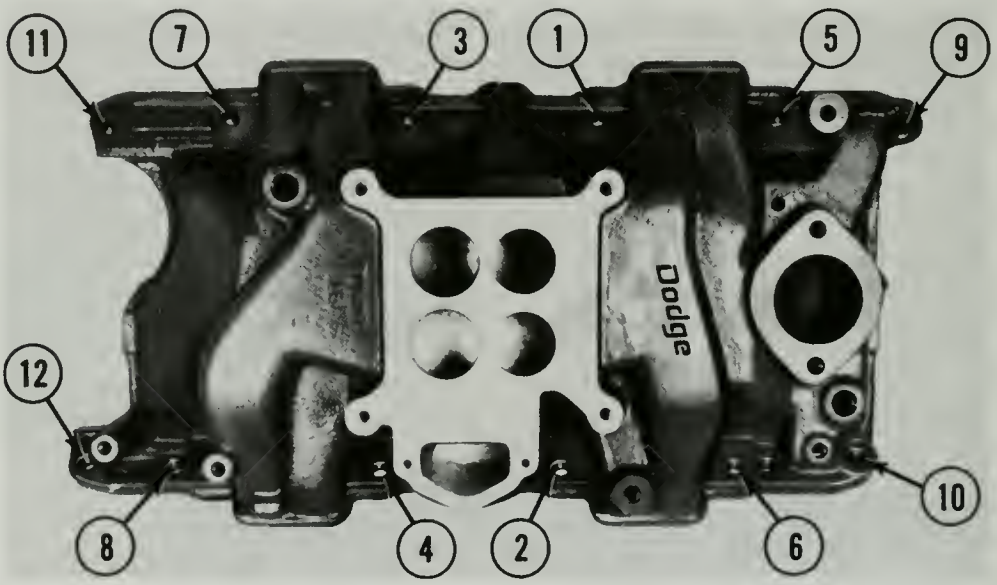


These are the two most commonly used types of torque wrenches. The top wrench is a professional tool, with a ratchet feature and a torque-setting feature in the handle. When pre-set torque is reached, the wrench clicks. Lower unit is inexpensive weekend mechanic's type.



Cylinder head gasket should always be torqued with torque wrench, following manufacturer's recommended sequence. Most torquing sequences start at the center and work toward outside, and the one illustrated is typical.

Intake manifold is made of aluminum, and therefore tightening with torque wrench is desirable. You can almost always get the wrench in. Note this torquing sequence, like the cylinder head, starts at the center and works toward the outside.



thread resistance, note the torque required to pull the nut through its last full turn before exerting any tightening torque. Never check thread resistance anywhere except during the last full turn of the nut.

All manufacturers' specified torque readings are for clean and lightly oiled threads. You can't use rusted bolts or nuts and expect to get reliable settings, even if you compensate for thread resistance.

The torque wrench should always be used to tighten cylinder head bolts or nuts, connecting rod and bearing caps, clutch pressure plate bolts, wheel bearing nuts and any aluminum parts, including intake manifolds.

General Torque Tightening Specifications

Bolt Size	Cast Iron	Aluminum	Brass
1/4-20	80 lb./in.	60 lb./in.	61 lb./in.
1/4-28	100 lb./in.	84 lb./in.	77 lb./in.
5/16-18	11-12 lb./ft.	8-10 lb./ft.	8-9 lb./ft.
5/16-24	13-14 lb./ft.	10-11 lb./ft.	9-10 lb./ft.
3/8-16	21-23 lb./ft.	17-19 lb./ft.	14-16 lb./ft.
3/8 24	23-25 lb./ft	19-21 lb./ft.	15-17 lb./ft.
7/16-14	33-35 lb./ft.	27-29 lb./ft.	24-26 lb./ft.
7/16-20	35-37 lb./ft.	30-31 lb./ft.	25-27 lb./ft.
1/2-13	46-48 lb./ft.	37-41 lb./ft.	33-35 lb./ft.
1/2-20	48-50 lb./ft.	42-44 lb./ft.	35-37 lb./ft.
9/16-12	60-62 lb./ft.	57-58 lb./ft.	44-46 lb./ft.
9/16-18	67-69 lb./ft	63-64 lb./ft.	49-51 lb./ft.
5/8-11	104-106 lb./ft.	93-96 lb./ft.	73-75 lb./ft.
5/8-18	116-118 lb./ft.	101-104 lb./ft.	93-95 lb./ft.
3/4-10	144-146 lb./ft.	128-131 lb./ft.	102-104 lb./ft.
3/4-16	140-142 lb./ft.	132-134 lb./ft.	100-102 lb./ft.
7/8-9	218-220 lb./ft.	191-194 lb./ft.	157-159 lb./ft.
7/8-14	217-219 lb./ft.	196-198 lb./ft.	156-158 lb./ft.
1-8	323-325 lb./ft	293-298 lb./ft.	232-234 lb./ft.
1-14	292-294 lb./ft.	264-266 lb./ft.	210-212 lb./ft.

* These specifications can be followed when specific factory specifications are not available. The many variables of fasteners and materials make the above table useful as a guide only. On especially critical applications, individual manufacturer's specifications must be followed.

The tightening of cylinder head bolts or nuts is a standard part of a major tune-up. Cylinder head gaskets take a "compression set" and to prevent compression losses, they must be periodically retightened.

All car manufacturers specify a sequence for tightening cylinder head bolts or nuts, and the sequence should be used whenever available.

If unavailable, you should tighten the bolts or nuts from the center out, as illustrated, on cast-iron engines. Aluminum engines are another matter; always obtain the manufacturer's sequence.

Tightening to specifications should always be done in stages. If the specified torque is 50 pound/foot or under, tighten all nuts or bolts in three roughly equal stages, such as 15, 30 and 50.

If the specified torque is more, tighten all nuts or bolts in four roughly equal stages. Example: if final torque is 85 pound/foot, tighten first to 20, then to 40, then to 60, then to 85.

In addition to those situations where the use of the torque wrench is mandatory, use it wherever it can fit in. Uniform tightening of all nuts or bolts on a particular assembly can only help its long-term performance.

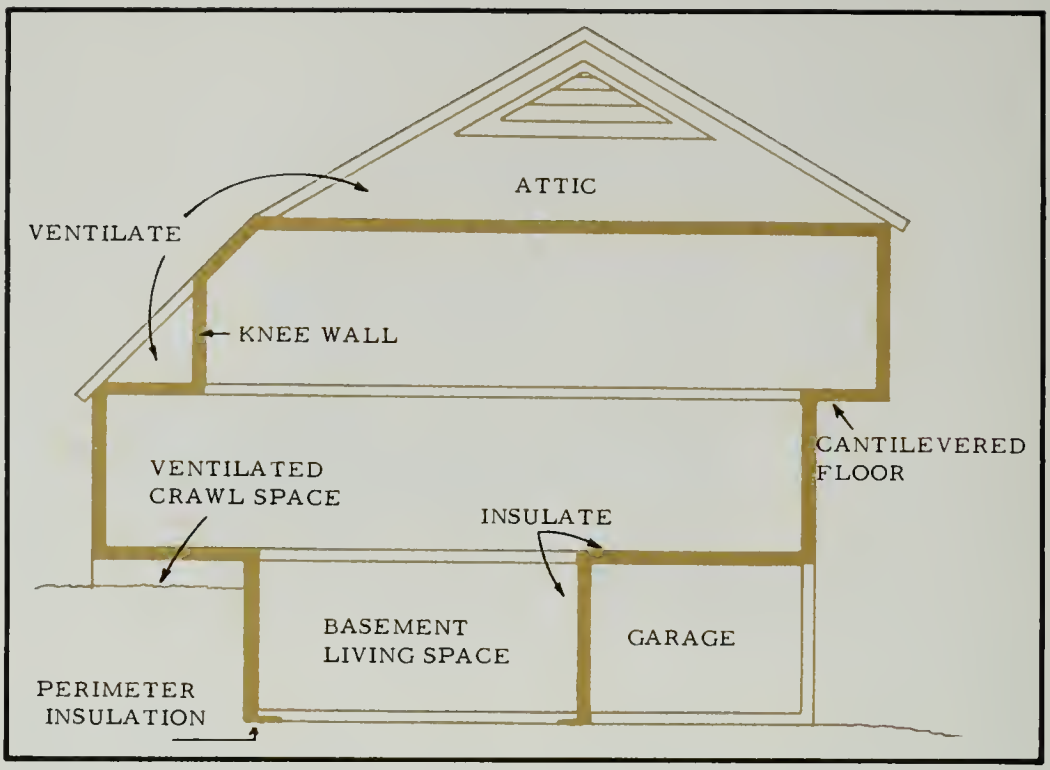
P.W.

See also: ENGINE; PARTS REPLACEMENT, ENGINE; TUNE-UP, ENGINE; VALVES.

FORMULA FOR CALCULATING EXTRA TORQUE FOR ACCESSORIES

$$TA = \frac{TW \times (L + A)}{L}$$

TA = Torque exerted at end of the adapter or extension
TW = Torque wrench scale reading
L = Lever length of wrench
A = Length of the adapter extension



Reducing Your Cooling and Heating Bills

With the correct insulating material properly placed in your home, you can improve the effectiveness of temperature stability by 300 percent

GOOD HOME INSULATION is a real money saver because every dollar invested to improve insulation will be returned many times over through savings on money spent for heating and air conditioning. So learn all you can about proper insulating techniques to be sure that your builder is doing this all-important job right.

You will not have to become a heating engineer to understand the differences between good and poor insulating methods. So do not let the technical jargon and simple arithmetic you have spotted on these pages scare you off. Even if you do not bother to make your own insulating heat loss calculations, you will learn enough about the language of insulating to protect your own economic interests. For example, a fast-talking contractor or insulation salesman might talk only about the relative "k" values of competing materials; if you insist that he talk in terms of "R" and "U" values, he will stop selling you a bill of goods and instead sell you good insulation.

heat pump: see fuels

And if you watch your home being built from scratch, it is relatively easy to make sure that it is being properly insulated.

Where to insulate. Obviously, all exterior walls of a home must be insulated by completely filling the spaces between studs with insulating material. But that in itself is not enough. Even the smallest spaces, like those between windows and door jambs and frames or pockets behind pipes, should be packed with insulation. Places that require insulation that might be overlooked include the walls that separate an unheated garage from the house, knee walls in attic rooms, dormer walls and ceilings, walls separating unheated storage areas, and in split-level homes those wall sections that extend higher than the walls of an adjacent, lower level. Floors over unheated garages, workshops, or ventilated crawl spaces require insulating, as do those over porches or in cantilevered sections of a home. Basement walls need insulating only if the area is used for living purposes. Basement floors require only perimeter insulation because, surprisingly, very little heat is lost through the floor except at the edges. The perimeters of slab-on-grade structures also need insulating.

All insulated areas should include effective vapor barriers. These may be metallic films on the insulating batts or blankets, or separately installed sheets of thin plastic. (Never add new insulation over old insulation that has a vapor barrier without first removing, or at least slashing long gashes into the vapor barriers to permit air movement throughout the insulation.)

Since considerable amounts of heat can be lost through even the tiniest of cracks, all windows and doors should be fitted with weatherstripping. Do not forget to weatherstrip that attic access panel. All other cracks and crevices should be caulked, and for a really thorough job add special sealers under thresholds and between sills and foundations.

Windows and doors. A great deal of heat is lost through door panels and through window glass. Storm windows help, but double glazed or even tripple glazed windows are preferable. There is much to be said in favor of low-maintenance metal window frames, but the convenience is paid for through increased fuel bills because metal is a far more efficient conductor of heat than is wood. If you have sliding glass doors, be sure that they are fitted all around with good weatherstripping.

Types of insulation. Insulating materials are made of several different substances and they come in various physical forms. For example, flexible or semi-rigid batts and blankets may contain mineral or glass wool, or wood fiber. Wood fiber is an excellent insulator, but it cannot double as a firewall as in the case of mineral wool insulation. Rigid insulators made of synthetic materials (polystyrene, urethane, or formaldehyde foam) are popular because of their ease of installation. Loose fill (blown) types of insulation are especially convenient in special applications, as in attic floors (and throughout old houses that are to be insulated for the first time.) And look into insulating boards which can replace wood exterior sheathing and even the conventional plaster bases of interior walls and ceilings; you may obtain excellent insulating results and save money in the process. If the weather in your area is severe, it may be wise to use both insulating boards and in-the-wall insulating materials such as batts or blankets.

When you compare the relative costs of competing insulating materials be sure to make the comparisons in terms of insulating efficiencies, not merely on a square foot or even volume basis; different insulators having the same volumes may be quite different in their insulating properties. When figuring costs, do not forget the relative installation labor costs.

Climatic considerations. Find out the degree day value for your area. This can be obtained from the *Climatic Atlas of the U.S.* published by the National Weather Service (your local library may have a copy), or by contacting your local weather bureau.

Once you know the degree day value, you can draw certain conclusions, in a general way, about the amount of insulation your home needs. We will have more to say about this later.

Do not assume that maximum insulation is required only in northern climes; remember that in warm climates you may be just as interested in saving money on air conditioning costs. Also, the type of heating system you install can be a factor. Homes heated by means of radiant electric heaters require especially good insulation because radiant heat is lost through walls more easily than heat introduced into the home by systems that depend mainly on convection heat transfer (conventional hot water and forced air systems).

At this point we should perhaps add a word about comfort. You surely have noticed that sometimes a very warm room —as indicated by a thermometer—seems chilly or "drafty." Chances are you feel uncomfortable in such environments because the room walls are too cold, and because your body loses heat mainly through radiation to such cold surfaces. The only way to eliminate such "drafts" is to use enough insulation to keep room walls relatively warm.

How to calculate heat losses. The only way you can accurately determine how good your home insulation will be is to calculate how much heat is lost through the house walls. Before reading on, refer to the Insulating Language chart, paying particular attention to what is said about k, R and U values.

Actually, we shall be concerned only with R and U values. Just bear in mind that the k values are not useful for comparing insulating materials you buy because they do not take into account the actual thicknesses of commercially available insulators. The R values are far more meaningful because all insulators—regardless of their relative thicknesses or the materials used to make them—having the same R values are equally efficient insulators.

Refer now to the chart, How To Calculate Heat Losses Through Walls, showing how you might calculate heat losses through the wall of a shingled house. In this example we assume that the home is located in an area where the Winter Design Temperature is +5°F. This is merely the lowest expected temperature in the area; do not confuse it with degree days. The R values shown for various materials used in the wall construction are derived from reference tables that list every conceivable type of construction material.

To find the total thermal resistance of a wall, simply add the R values of the individual components. Note that the only difference between the insulated wall and uninsulated wall tabulations is that one includes the R value for insulating material rather than for air. At this point it is already obvious that the insulated wall is more than 3.5 times as effective a heat barrier as the uninsulated wall.

To figure actual heat losses, you must first convert the total R values to U values (just divide each total R value into 1). All that remains to do is subtract the winter design temperature (in this case +5) from 70° and multiply the result by the U value. Thus, for the uninsulated wall: (70-5) x 0.25=16.25 Htuh/sq. ft. of wall section. After making a similar calculation for the insulated wall, you see that 3.57 times as much heat is lost through the uninsulated wall than through the insulated wall. If you were to choose insulation rated at R-13, you would save still more heat.

Remember that you will lose much more

Rigid urethane foam, sprayed in recommended thicknesses, is one form of insulation. Space between siding and stud face is filled until full stud thickness (3-5/8-inch) is obtained.

Urethane board is designed for use with concrete, brick or masonry exterior walls. Nails are driven through furring channels embedded in insulation to secure to walls.

heat through doors and especially through windows than through well-insulated walls. For example, the U value for double-glazed insulating glass having a ½-inch air space is 0.58; hence the heat loss in a +5° winter design temperature area would be about 37.7 Btuh/sq. ft.—about double the heat loss through an uninsulated wall of the type assumed here. If the double-glazed windows have only a ¼-inch air space, you lose 42.2 Btuh/sq. ft. And if you elect to use single glazed windows, the heat loss jumps to 73.45 Btuh/sq. ft. or 4.5 times greater than through the uninsulated wall!

Clearly, this means that it pays to use double-glazed windows because the initially greater cost will in time be written off through savings in fuel bills. And here is another point to bear in mind. If you want to live ultramodern, in a house having glass walls, be prepared to pay extra for this luxury through higher heating and air conditioning costs.

Some practical generalizations. If you do not want to bother with calculations like these—simple as they are—you aren't likely to go wrong if you simply tell your building contractor to figure on insulation that will give your house walls, floors and ceilings U values no higher than 0.08. For the sake of economy, you can do with a little less insulation if you live in a relatively warm area. Where degree days go no higher than 4000, wall and floor U values can be increased to 0.10; where annual degree days do not exceed 2000, you can get by with U values of 0.13 for walls and floors. In any case, stick with the 0.08 maximum figure for ceilings wherever you live.

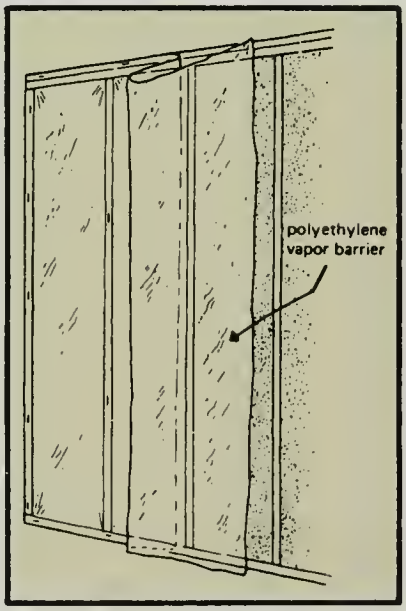
If you have the R values for all the construction materials used in your house walls, you can determine easily whether a suggested insulating material will provide

the degree of insulation you want. Using our shingled house as an example, note that all the construction materials, excluding insulation, add to 2.85 (total R value). Suppose that your insulation salesman says his product, rated at R-7, is all you need. If you add 7 to 2.85 and divide this into 1 you find that the U value works out to 0.10. If you live in an area having an annual degree day higher than 4000, this insulation clearly would not be adequate for your walls, with the possible exception of basement walls.

One type of fiberglass insulation comes in rolls that can be snapped apart into batts for all standard stud width spaces.

When you have decided what kind of insulation will be used in the walls, floors and ceilings of your home, ask your builder to prepare a signed statement specifying exactly what materials are to be used and where. The statement should indicate the desired R values and what grades of materials will provide them. Be especially careful to obtain such a signed statement if you use blown material, and see that it specifies the minimum thickness and minimum weight per square foot of the applied insulation, and how many square feet of space can be covered by each bag of insulating material. Federal regulations require that such information be on each bag.

When pressure-fit blankets without vapor barrier are used, wall studs should be covered with polyethylene (right).



If blanket insulation is applied to ceiling, any gap between joist insulation needs to be filled with loose insulation (far right).

Most building contractors can be relied upon to do a good insulating job if you are prepared to pay for a good job. But there are those who will take advantage of people who obviously know nothing about the problems of insulating. So even if you do not want to get into the more technical aspects of home insulation, learn enough so that you can talk a good game. If you mumble about degree days and ask some knowledgeable questions about R and U values of proposed insulating materials, and especially if you insist on having a signed statement detailing what materials will be put where, the fast-buck artists are not likely to risk taking advantage of you.

See also: AIR CONDITIONERS; COOLING; FUELS; WINDOWS.

INSULATING LANGUAGE

Degree day. This unit measures the coldness of heating seasons. It is the numerical difference between 65 degrees and the average outside temperature when the average is lower than 65 degrees. For example, if the mean temperature is 20 degrees, the degree day value for that day is 45. The degree day value for an entire year is the sum of 365 individual degree days. This unit is used to predict fuel requirements, plan optimal heating system capacities, and figure minimal insulation requirements.

K value. A measure of thermal conductivity. It indicates the rate of heat flow through a one inch thickness of insulating or other construction material. The lower the k value, the better the insulator. However, remember that an insulator having a relatively high k value may be better than a thinner material with lower k.

R value. A measure of resistance to heat flow. It is the reciprocal of the k value (R=1/k). The higher the R value, the better the insulator.

U value. Coefficient of heat transmission. It is a measure of the rate of heat flow through one square foot of building section (wall, floor or ceiling) in a given time under specified inside-outside temperature differences. It is the reciprocal of the total heat transfer resistance of all materials in a building section (U=1/total R). Lower the U value; better insulation.

Vapor barrier. A material which resists the flow of water vapor attempting to pass through the wall, ceiling or floor of a house.

Btuh. British thermal units per hour. Btu is a unit of measure expressing quantities of heat generated or consumed.

HOW TO CALCULATE HEAT LOSSES THROUGH WALLS

To calculate and compare heat losses through identical insulated and uninsulated walls (or floors or ceilings), total the R values of all layered construction materials and divide these totals into 1 to obtain the U values. Actual heat losses are figured by multiplying the U values by 70°F. minus the "winter design temperature" for your area. In this example, the assumed winter design temperature of +5° would be applicable in areas having 5,000 to 6,000 winter degree days—as in New Haven, Connecticut; Wichita, Kansas; Salt Lake City, Utah. Note that heat loss through the uninsulated wall is about 3.6 times greater than through an identical wall having insulation rated at R-11.

	R Values (Uninsulated Wall)	R Values (Insulated Walls)
Surface Coating (outside)	0.17	0.17
Surface Coating (inside)	0.68	0.68
Shingle Siding (16" with 7½" exposed)	0.87	0.87
Building Paper	0.06	0.06
Plywood Sheathing (½")	0.62	0.62
Gypsum Board (½")	0.45	0.45
Air Space (3½")	1.01	
Insulation (R-11, 3" to 4" thick)		11.00
	3.86	13.85
U Value (1/R)	0.25	0.07
Heat Loss in Btuh/sq. ft. of wall section (U x 70° minus winter design temp.)	16.25	4.55
Heat Loss Ratio	3.57	1.00

How to Maintain and Repair Hot Air Gas Furnaces

Most of the things that can go wrong with these heating units can be repaired by an average homeowner without the expense and delay involved in employing a repairman

Gas furnace filters should be changed regularly. Do not attempt to clean and reuse one-shot filters.

BEFORE YOU REACH for the phone to call your heating serviceman the next time your gas furnace conks out, check the following three spots for possible trouble.

Is the circuit breaker or fuse blown? Since gas furnace controls are connected to the fuse box on a separate circuit, when its fuse blows no other appliance or lights in the house are affected to indicate the fuse has blown. The best way to check a fuse is to replace it with a new or known good one.

Is the furnace pilot light burning? Don't worry about what may have caused the pilot light to go out at this time, we'll cover that later. For now, try to relight the pilot. First, be sure to shut off the main gas valve for about five minutes to clear the furnace of gas before attempting to relight the pilot. Also turn the thermostat down to the lowest setting (about 55°) so that the main burner will not go on suddenly as you are lighting the pilot. Then follow the manufacturer's directions for relighting the pilot. You will find this printed on a metal plate fastened to the furnace.

Check the thermostat contact points. Air circulating through the thermostat carries dust and lint which collects on the contact points and prevents them from closing the circuit. To clean the points first loosen the screw under the thermostat and remove the cover by lifting outward and upward.

If the thermostat is a mercury-switch type, dust cannot collect on the contact points and therefore could not have caused the furnace to stop operating. If the thermostat is the bimetal type, place a piece of paper between the points and, while gently holding the points together with your finger, move the paper back and forth between the points about six times. Then remove the paper and turn the thermostat dial indicator up above room temperature. Watch the contact points as they come together for a very small spark which indicates that electrical contact is made.

If the cause of your furnace not operating was due to a blown fuse or dust on the thermostat contact points, your prob-

lems are over, at least for the time being. If, on the other hand, you could not relight the pilot or could not keep it burning after relighting it, here's what to do.

Servicing the pilot light. A clogged or partially clogged pilot light orifice is the most frequent cause of pilot failure. One quick way to try and clear the orifice is to close the manual pilot valve, disconnect the pilot gas supply tubing at this valve (Y in the drawing), and blow through the tubing with your mouth. If, after reconnecting the gas supply tubing and opening the pilot valve, you are able to light the pilot and get the furnace back in operation, do not be satisfied with this emergency method of cleaning the pilot. When you have the house heated and find the time, shut down the furnace by closing the manual pilot and main gas valves so you can do a real job of cleaning the pilot.

If you have a furnace with an automatic pilot, remove the pilot assembly by first disconnecting the two gas supply tubes at the pilot, or at the other end of the tubes where the lines connect to the valves, whichever is most convenient on your installation. Now, with a screwdriver, disconnect the two wires at the base of the pilot assembly. Then remove the two screws which hold the pilot assembly to its mounting bracket and lift the entire pilot unit out.

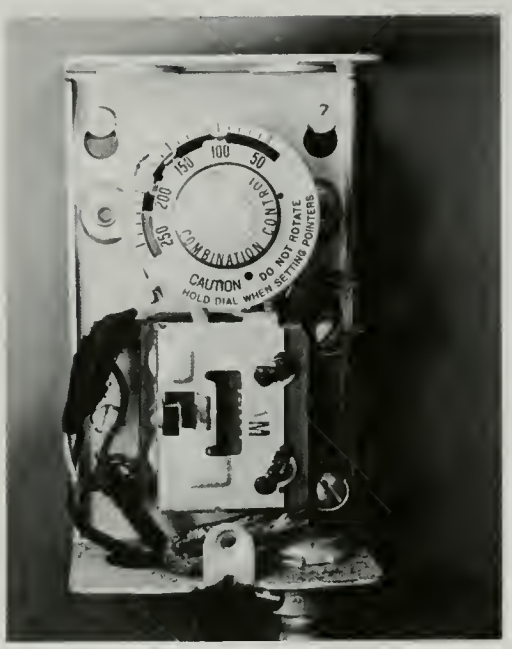
Removing the two screws that hold the shield in place will also release the hex-shaped orifice housings. On some types of furnaces you may be able to conveniently reach and remove these two small screws without first removing the entire pilot assembly and thus save yourself that time and trouble. In either case, next remove the orifice housings from the tubing connectors using two wrenches.

The orifice is a tiny hole drilled through the center of the orifice housing, and is the seat of the trouble when it becomes clogged. A heating service man has a tiny drill which he uses to clean the orifice. If you do not have such a drill, take a round toothpick and shave one end down with a knife. Insert the toothpick into the orifice, spinning it between your fingers as you do so. Do this at both ends of the orifice. Then hold the orifice housing up to the light to check if you can see through the orifice. Never use a metal wire to clean an orifice since the wire, which is harder than the metal of the orifice housing, would scratch or enlarge the orifice and ruin it. If you cannot clean it with a toothpick, purchase a new orifice housing of exactly the same size and type from your local heating contractor. Inspect and clean out the inside of the pilot stem and primary air holes in the sides of the orifice housing. Then reassemble the pilot unit and reinstall it in your furnace.

Note the length of the pilot flame after relighting it. It should be a blue flame extending outward and upward about 1½ to 2½ inches from the pilot stem. If the pilot flame is too large or too small or has a yellow tip, regulate the flow of gas to the pilot with the adjustment screw which is concealed under the cap screw on the manual pilot valve body. To reduce the flame, turn the adjustment screw clockwise; to increase the flame, turn the adjustment screw counterclockwise.

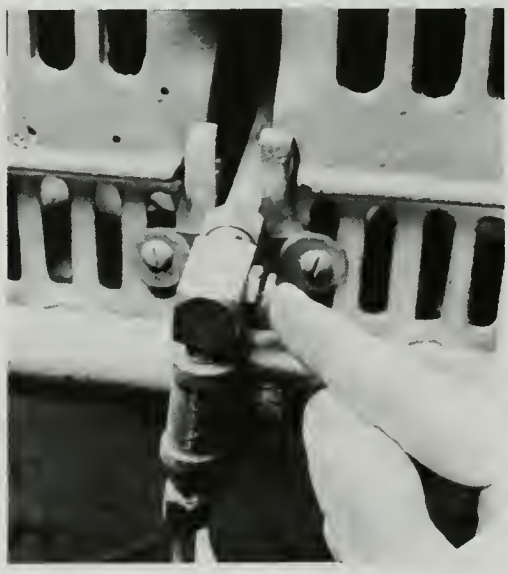
If your furnace has the thermocouple type of automatic pilot, disconnect the gas supply tube at the manual pilot valve and the thermocouple lead. Then remove the screws holding the pilot bracket and take out the entire assembly.

Remove the thermocouple by unscrewing the retaining nut. To get at the orifice, first remove the tubing connector and then the orifice housing. Here again, if it is convenient on your furnace to reach in and remove the tubing connector and orifice housing you will not have to go to the trouble of removing the entire pilot assembly.



▲ *Thermostats require periodic attention. Remove cover and dust interior with a soft brush. If your thermostat has contacts, rather than a mercury switch, make sure they are clean.*

▼ *Button used in relighting pilot is similar to devices performing the same function on most gas furnaces.*



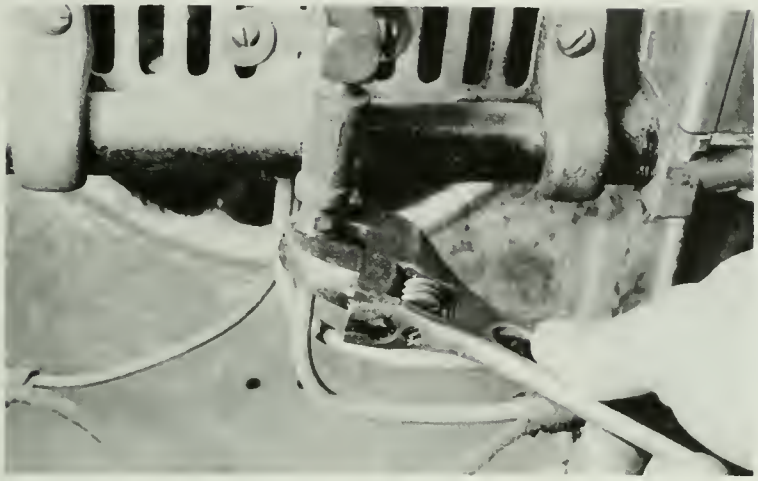
The method of cleaning the orifice will depend on the make and type. If it has a single tiny hole in the center of the housing, use the sharpened toothpick method. If the orifice has two tiny holes it cannot be cleaned with a toothpick because the holes are smaller and usually drilled at an angle. The best method of cleaning a dual-orifice is with a toothbrush or bristle paint brush. Never use a wire brush or wire to clean the orifice. If you are unable to clean the orifice with a bristle brush, take the orifice to your local heating contractor and purchase a new one of the exact type and size. Numbers stamped on the outside of the orifice housing indicate type and hole size. While you have the orifice removed, clean the pilot body and primary air intake openings too.

After reassembling and installing the pilot unit in the furnace, light it and regulate the flame with the adjustment screw on the manual pilot valve. A properly adjusted pilot should burn with a soft, noiseless blue flame. Yellow tips on the flame indicate an obstructed primary air opening or too much gas in relation to air. A small flame occurs when the orifice is partially clogged.

If the pilot light will not continue burning even though the upper ½-inch of the thermocouple is heated by the pilot flame, check the connection at the opposite end of the thermocouple lead. If this does not help in maintaining a continuous pilot flame, remove the thermocouple and its lead, and replace with a new thermocouple.

Electrical trouble-shooting. To check the electrical circuit of your furnace, make up a jumper wire from a 12-inch length of #14 wire by removing the insulation about ½-inch from each end.

Basically, the low voltage circuit (24 volts) of most home gas-fired furnaces are similar in that they are wired in series. That is, like an old fashioned string of Christmas tree lights of the type when one bulb burns



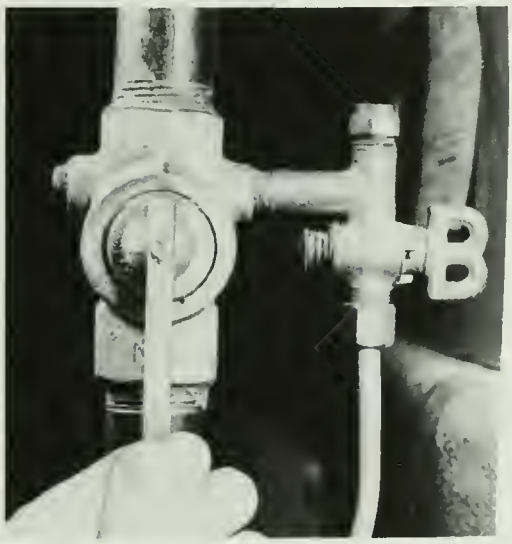
Semi-annual inspection should include the tightening of couplings.

Gas line is open when valve handle is in line with pipe. The line is closed when handle is perpendicular to it.

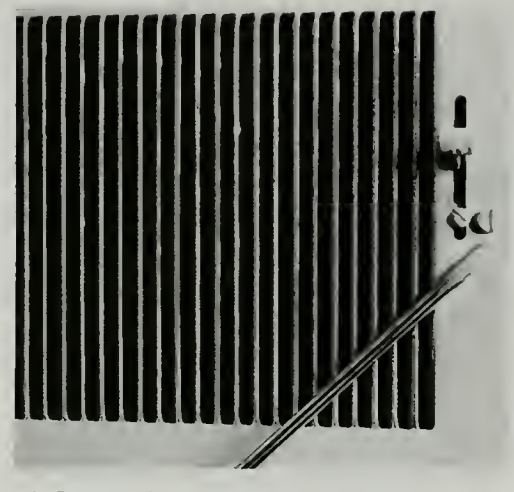
out—all lights go out. The same applies to the furnace circuit—when one of the controls does not work, neither will the rest of the controls.

If you find the pilot light on your furnace burning but still cannot get heat when you turn up the thermostat, first check the points in the thermostat for dust. If this fails to put the furnace in operation, locate the transformer on your furnace and place one end of the jumper wire on one of the low voltage terminals. Momentarily touch the other end of the jumper wire on the other transformer terminal. You should get a spark indicating that the transformer is working. If you do not get a spark, again check the house fuse box. Even though the fuse looks good, try another new fuse. If the furnace still refuses to function, go back to the transformer. Some transformers have a one-ampere fuse above the two terminals. Place your jumper wire or a low-voltage test lamp across the two fuse terminals. If the furnace goes on, the one-ampere fuse has blown and must be replaced.

If your furnace transformer does not have such a fuse, shut off the current to the furnace at the house fuse box and examine the splices and wires leading into the transformer. *(Caution: This is the 120-volt line. Be sure the current is off and never use the jumper wire across terminals on this side of transformer. Use a test lamp if necessary.)*

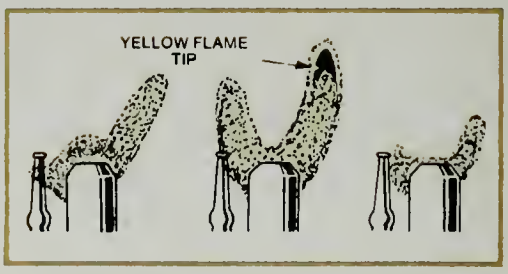


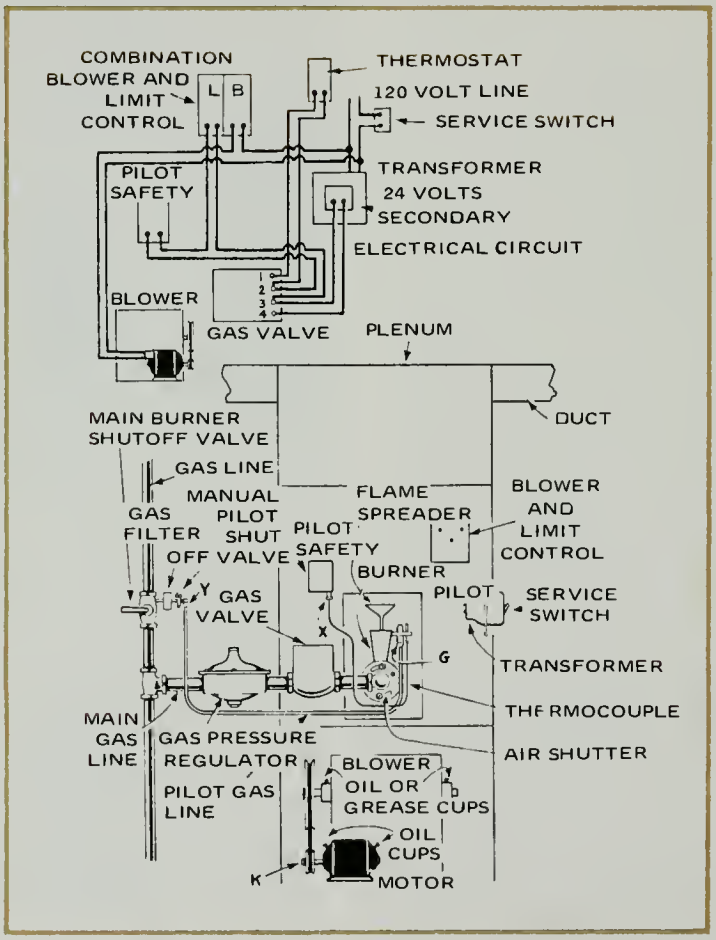
If you find one wire burned off where it goes into the transformer, no repair can be made. If the wires look good, then the transformer is defective because of a break in the coil wires inside and the transformer must be replaced. It is normal for transformers to produce a slight hum, but if the hum suddenly grows excessive or if it gives off a burnt odor, shut off the current and replace it.



Remove hot air register and vacuum space within the duct to prevent dust build-up.

With the transformer checked out and still no luck in starting the furnace, go to the pilot safety control. Place the jumper wire on the two wire terminals and if the heater comes on it will indicate that the pilot safety is at fault, provided the pilot burner is clean as mentioned before. If a thermo-





couple is used on your furnace, this could also be the cause of the trouble. Check the end of the lead coming from the thermocouple (X in the drawing), be sure it is making good contact. A loose connection here could cause the pilot safety to cut out. The connection should be finger tight, plus a quarter turn with a wrench.

Your next check point is the blower and limit control. *Remember that the blower control portion of this control carries 120-volts—so be careful.* Remove the control-box cover and place your jumper wire across the two high-limit terminals. If the furnace is cold and it starts up with the jumper across these terminals, the micro-switch on the control is at fault and must be replaced. You can purchase a new switch and need not replace the entire control. If, on the other hand, the blower runs continuously and will not shut off automatically, an element in the blower control is defective and you will have to replace the whole control—both blower and limit.

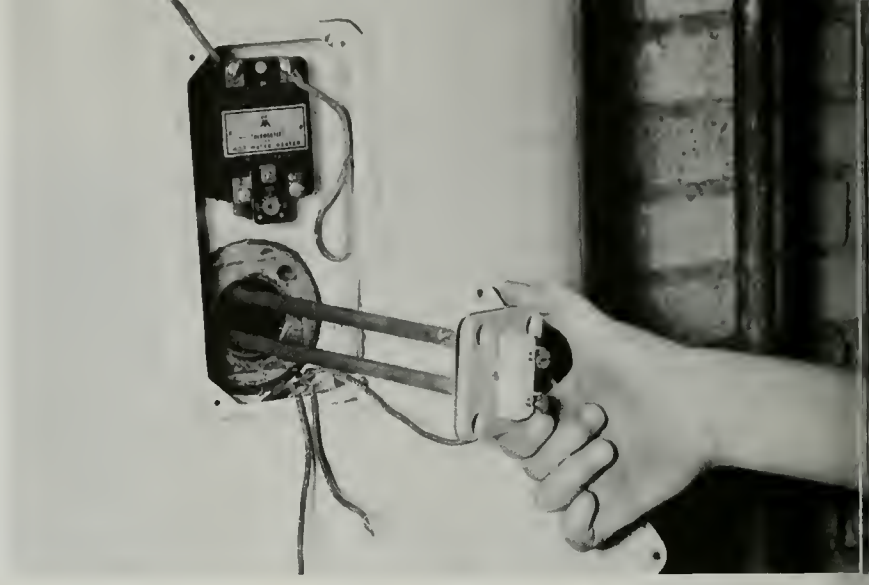
If your furnace has been operating on and off quite frequently with little or no heat circulating through the house it could be due to an overheated plenum caused by clogged filters or a burned-out blower motor. Check the filters first and replace them if dirty. As an emergency measure you could use a vacuum to clean the filters. A serviceable filter is one which you can see the light of a flashlight through. While at the filter compartment check the motor-to-blower belt for looseness or breaks. Also attempt to turn the blower pulley to make certain the blower bearings are not frozen tight from lack of oil or grease.

If the wires of the low-voltage circuit on your furnace are connected to four terminals on the gas valve, you can quickly check out the circuit wiring with the jumper wire. The terminals will be numbered 1, 2, 3 and 4. Putting the jumper across 1 and 2 will short out the thermostat circuit; across 2 and 3 will short out pilot safety and high limit controls; across 3 and 4 will short out the transformer. Holding the jumper across 3 and 4 will only give a spark indicating the wiring from the transformer is good. If no spark shows, inspect wiring for breaks. If holding the jumper across 1 and 2 or 2 and 3 makes the furnace operate, test the other ends of the wiring at the terminals on the thermostat, pilot safety or limit controls. If nothing happens you will know that the wiring between the control and the gas valve terminals is defective. Look for bare wires touching metal or broken wires.

If the wiring appears good, go to the thermostat, take off the cover and remove the three screws that hold the thermostat to the wall bracket. Gently pull out the thermostat and place the jumper across the two terminals that the wires coming from the wall are connected to. If this causes the furnace to operate, the thermostat is defective and must be replaced. If nothing happens, the wiring from thermostat to gas valve is at fault. Since this wiring, in most cases, runs through the walls of the house and cannot be inspected, it will have to be replaced or temporary wires run to the furnace until replacement can be made. Remember, a jumper wire is for testing purposes only.

Do not attempt to use a jumper wire to bypass a control and thus temporarily operate your furnace, because you will be removing the safety of operation offered by that control. This is important because you could overheat the furnace and cause a fire.

Although you may not be able to get your furnace into immediate operation if a defective part is the trouble, you will save time by knowing exactly what part is needed so that you can pick it up and install it yourself or tell your local serviceman what is needed and thereby save him the time he would have to spend trouble-shooting.



➤ *Most important step in installing new element is to have perfectly smooth surfaces butting against the gasket.*

Bringing Your Electric Water Heater Back to Life

If water is coming out of your faucet cold, you may only need a new, easily installed heating element

IF YOU HEAT WATER by electricity and suddenly you are not getting full power, you may need a new heating element. You can easily install it with a few common tools, a dab of shellac and sandpaper.

First, turn off the switch, then remove shielding covers and, gingerly, touch the exposed end of the elements. If the unit is cold, it is defective.

Your local appliance dealer either stocks the replacement or should be able to get it for you promptly. To assure receiving the proper type, furnish him with make, model and capacity. The shape may differ, but wattage should be the same.

With the switch off and while draining water from the tank, save time and future guess-work by making a rough sketch showing color and location of each wire. Tape it to the tank housing for ready reference. Disconnect wires at terminals on element and thermostat with a sturdy screwdriver. Bend freed wires back from the work area.

Apply gradual force to free bolts securing element to tank. After removal, wire brush corrosion off bolt threads. Pull out heating element.

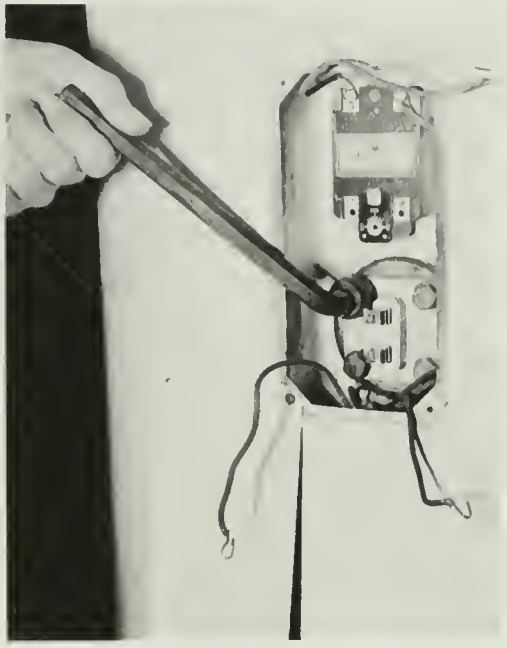
Scrape off every bit of the old gasket left around tank hole with an old chisel, stiff putty knife or screwdriver. Be sure to sand this surface smooth because a good seal with the new gasket is vital.

Prepare the new heating element by sanding smooth any burrs or rough spots on its gasket side. Shellac the gasket in place on the unit, then shellac the tank gasket area and place element in position. Replace bolts and tighten them alternately. Scrape any dirt from wire ends with a knife and connect to proper terminals as indicated by your sketch.

Remember to fill the tank with water before throwing the switch back on. In a short while, you should be all set for that hot shower. J.K.

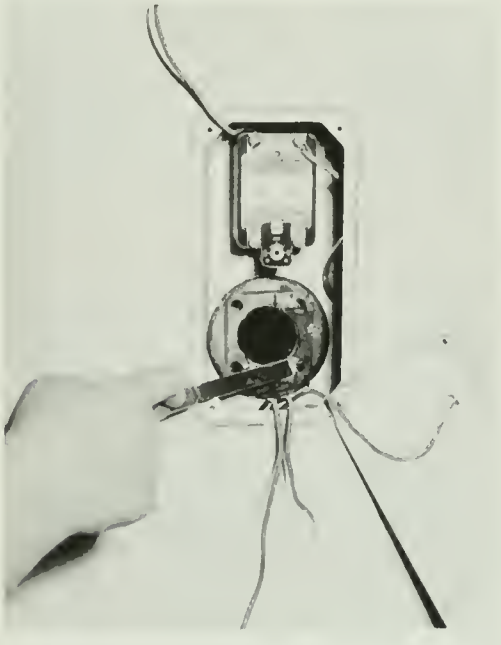
See also: PLUMBING.

▲ *Save time and guess work by making a rough sketch of color and location of each wire and tape it to housing for quick reference.*

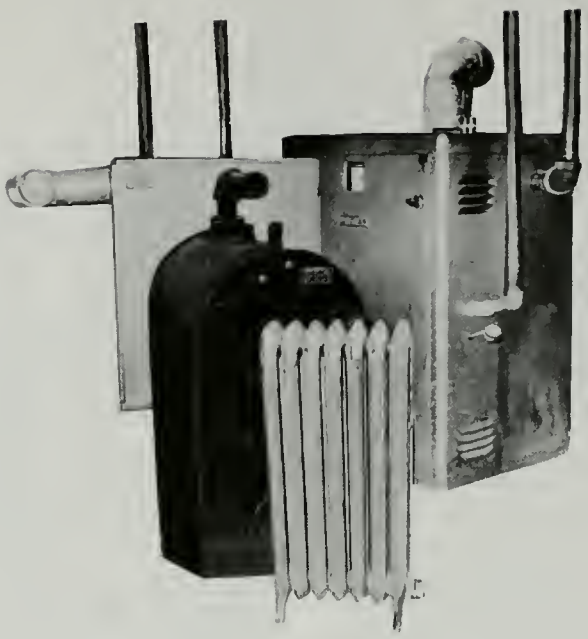


▲ *Use a socket wrench or deep-bend box end wrench to reach the bolt heads and apply gradually increasing pressure to free them.*

▲ *Removal of old unit sometimes requires a gentle tap or two with a hammer to free the head from the old gasket.*



▲ *Roughened area remaining on tank must be thoroughly scraped and sanded smooth before new heating element is attached.*



Balancing Hot Water Heating Systems

Using proper venting techniques will give you a more even distribution of heat so all the rooms in your house can be the same temperature

SINCE THE EARLY DAYS of automatic heating, the biggest complaint is that some rooms are persistently cold. They simply do not get enough heat, even though the thermostat is set high and the rest of the house is toasting.

In older homes still equipped with steam heating systems the answer to this problem can be said in a single word—venting, a subject which is perhaps least understood by homeowners. The average trouble-shooting approach is to look only to the heating plant as the source of heat. But the unit may be working perfectly and still junior's room and the bathroom are chilly in the morning.

Venting. This is the discharge of air from the cold radiator, permitting steam to enter. This displacement action is accomplished by an air valve in the radiator at the opposite side to the radiator shutoff valve, which is the entry point of the steam.

Any radiator in the system can be made to give more or less heat by having a larger or smaller vent valve opening. In other words, the flow of steam to various radiators is controlled by varying the venting speed.

Now, how does all this work in practice? The automatic heating plant ordinarily operates in short firing cycles. The radiators nearest the furnace receive the steam first, and the firing cycle will have ended before steam has reached the farthest radiators.

When the firing cycle starts again, the same nearby radiators will be heated, and the rooms at some distance from the boiler again will be short-changed. To overcome this, the homeowner raises the thermostat to call for more steam, thus extending the firing period—from about 20 minutes to perhaps 40 minutes or even more. This means, then, that the nearby radiators are sizzling and their rooms uncomfortably hot. Windows are opened in the overheated rooms while the bathroom is just beginning to warm up.

So you see the waste in fuel cost and unbalanced heating in the home, just to warm up one or two rooms.

Best solution. The correct way to handle this is with adjustable units that are designed especially for automatically fired one-pipe gravity steam systems.

These values provide for selecting different sizes of venting ports, so that some radiators can be heated more quickly, while others "wait their turn."

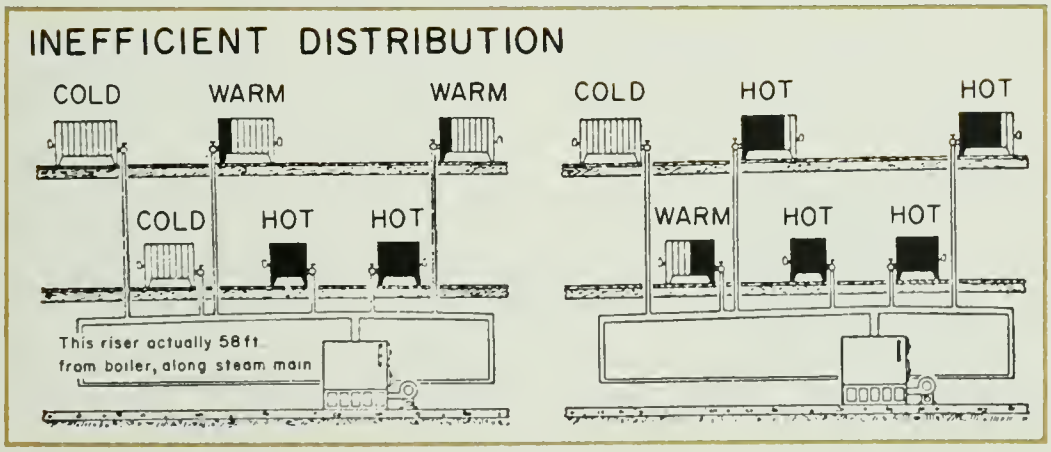
The diagrams show how this can be made to work for you. The slow heating radiators—the ones in rooms farthest from the furnace—are adjusted for quickest venting. Then the other radiators heat up.

But there are other factors. There is no reason to make an about face and starve other rooms for heat, causing another imbalance. With a bit of painstaking adjustment, you can see to it that all radiators warm up at about the same rate. Good quality air valves have nine different positions on the adjustment cap.

Regulating these according to the requirements of each radiator in relation to the others will give you comfortable, uniform heat throughout all the rooms in your house.

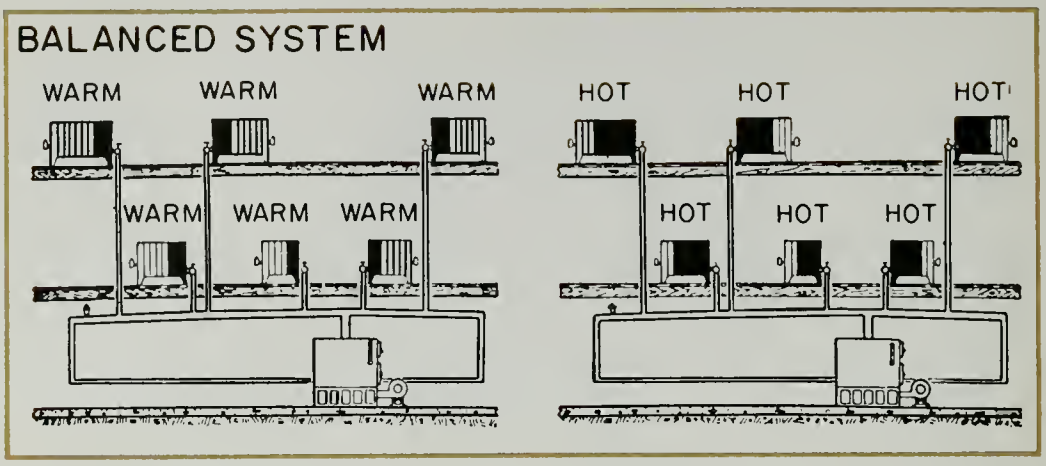
A radiator adjacent to the thermostat can be retarded so that others receive an adequate amount of steam before the thermostat is satisfied. Large radiators may be "held back" until small ones are fully heated. Bathrooms should be given priority in the heating scheme of things for more comfort.

How the air valve operates. When cold, the air valve is open. As steam rises, it forces the cooler air forward and pushes it out of the radiator through the valve port.



▲ *Burner on for 15 minutes. Radiators near boiler are partially heated.*

▲ *Burner on for 30 minutes. End radiators are still cold; those near boiler are sizzling.*



▲ *Burner on for 15 minutes. Every radiator is partially heated.*

▲ *Burner on for 30 minutes. Every radiator is properly heated.*

A small float is contained inside a chamber with a volatile liquid. When the air is driven from the radiator and steam comes in contact with the float, this liquid vaporizes, expands, and forces the float upward so that a pin is pushed into the valve outlet, thus closing the valve to retain the steam. It is the size of the port opening that is regulated by the adjusting or calibrating screw, as shown in the cutaway illustration.

In addition to the individual radiator air valves, there are quick vents in the basement mains, and often on separate riser pipes, permitting the steam to rise without buildup of excessive pressure. The boiler should be adjusted to cut off at about one to one and a half pounds, which is about maximum for a low-pressure system.

Balancing the radiators. Adjustment devices vary somewhat on different makes of valves. Usually a screwdriver or a thin coin is used to turn the valve cap until an arrow on the cap points to the desired number stamped on the valve shell.

Other valves have a center screw with a projecting pointer for the same purpose. After setting the pointer, be sure to lock the adjustment by tightening the cap screw, where there is one.

The higher numbers are for larger port opening, to speed venting and filling of radiator with steam. Low number adjustments slow up heating of the radiator.

Procedure for balancing your system is to set a slow venting rate for radiators nearest the boiler, and give maximum increase to problem radiators and those farthest from the boiler.

For a few days, inspect the radiators to see whether they now function correctly, with all heating up at about the same temperature at once and maximum heat quickest in the bathroom radiators.

Make further adjustments as necessary, increasing or decreasing the venting rate one notch at a time, in individual locations.

Not all vent valves are adjustable. If yours are all fixed ports, it may be possible to accomplish the balancing by switching those with larger vents to other radiators where faster venting is desired. Or purchase of just two or three new adjustable valves will be sufficient to solve a limited heating problem.

When properly balanced, the boiler will run the shortest possible length of time, for greater economy. Also, steam will be distributed before any noticeable pressure is

built up in the boiler. This means that the boiler is functioning with greatest efficiency and, consequently, eliminates certain problems that arise with excessive boiler pressure.

You may find, however, that even with the most careful adjustment, one or two rooms are still chilly because the intervals of heating cycle allow the radiators to cool. One effective way to correct this is to install an extra air valve on those radiators that are not functioning as you want them to.

It takes only a few minutes to drill another hole in the radiator, just under the present valve. After the opening is made, tap it for ⅛-inch (gas pipe size) and turn in the second valve. The actual diameter of ⅛-inch gas pipe is ⅜-inch. Use a tap with 27 teeth per inch. Be careful not to crack the radiator by forcing the threading die—work it gradually back and forth. The two-vent system is especially suited for use on extra large radiators.

The use of two vents make it unnecessary to hold back the other radiators so that a better balance is obtained all around.

Care of valves. Dirt, rust scale, and corrosion cause valve failure. Particles of scale or dirt get lodged in the valve seat and cause the unit to stick or leak. Any scale or corrosion that scores the valve pin prevents tight closure. A valve that's been dropped, or rapped with a stick can also become defective with the result that steam mist will escape and cause warping of the floor boards and other damage.

Most complaints of valve failure, however are due to some abnormal condition in the heating system, such as excess steam pressure and surging of water in the line due to back pressure in water-logged radiators.

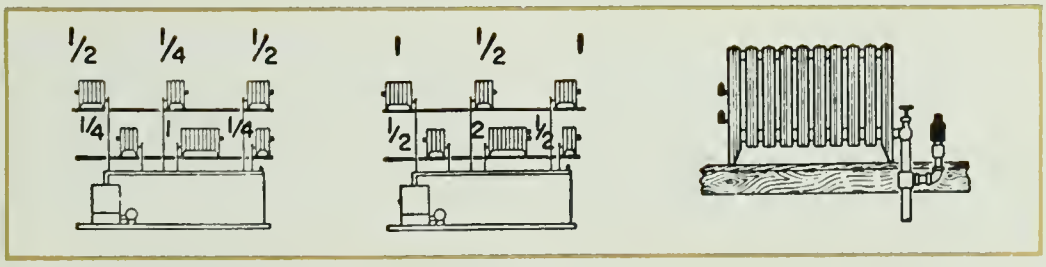
Air valves are also used on hot water heating systems in addition to steam. These valves work on a different principle. The action of the valve results from a series of hydroscopic discs that expand when wet, thereby closing the air valve. As the air reaches them, they dry out. Release the air and they close when water reaches them.

This type of valve should be mounted out of the primary pumping system so the pump surge will not splash water into the valve and cause it to close prematurely.

At the start of each heating season, "bleed" each radiator to remove trapped air. Open the valve while letting water into the system, close the valve as soon as water begins to pour out.

Never leave a steam radiator without its air valve. An unexpected firing of the boiler will result in escape of steam into the room, creating a dangerous situation that can cause suffocation.

Radiator noises. Hammering noises in radiator and return lines means that condensation water is not properly returning to the boiler. Check the level of each troublesome radiator to see if it is pitched



▲ *Throttling five vents to heat largest radiator gives total vent capacity of 2-3/4 vents.*

▲ *Two vents on largest radiator—no holding back. Total vent capacity of 5-1/2 vents.*

▲ *An extra air valve aids radiator which stays cold with 20 minute on periods.*

toward the supply end. If necessary, raise end of radiator on thin wood strips so that the condensed water will drain away.

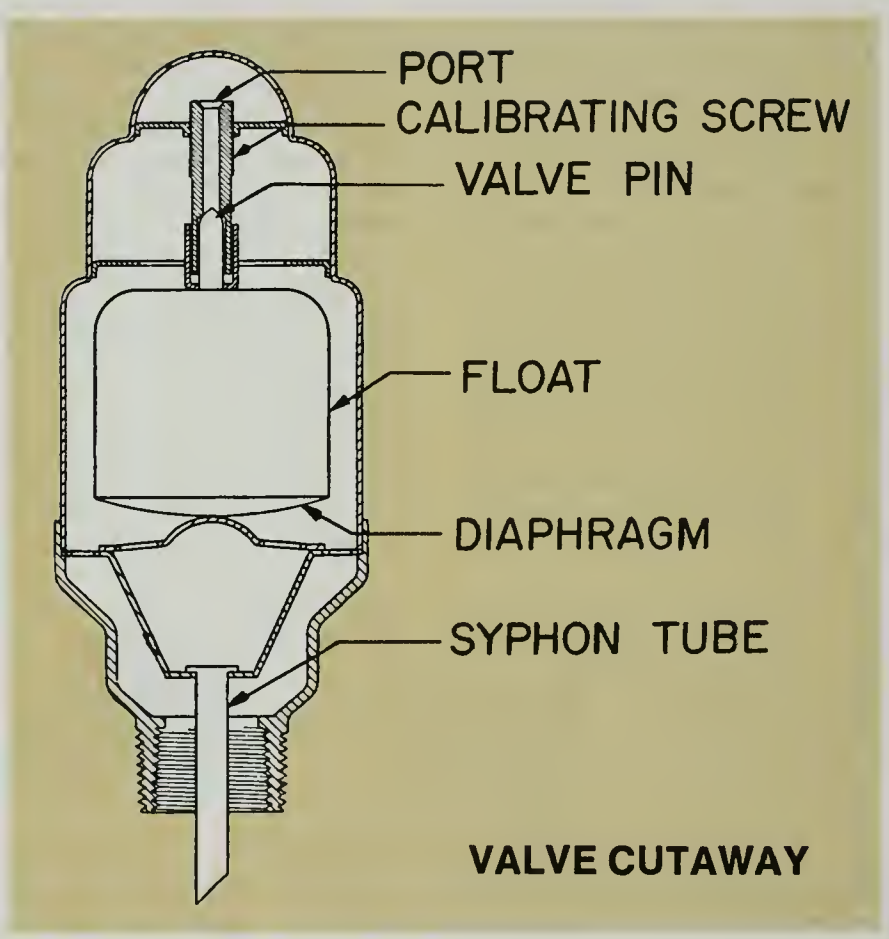
Check pitch of the steam main and the return lines for uninterrupted flow of condensation. Return lines should have quick-venting air valves that free the system and provide a fast, even distribution of steam throughout the entire system.

Lower the boiler pressure, if necessary, by adjusting the pressurstat. Pressures of more than one or two pounds cause condensate to remain suspended in the mains.

Some cases of water heating troubles are brought about when the return lines seem to fill, or where the flow of condensate appears to be restricted. These problems are the result of excessive differences in pressure. In other words, the pressure at the boiler is disproportionately greater than the pressure in the return lines. The result is that water will rise in the low end of the steam main, a distance of 2.2 feet for each pound difference in pressure, causing hammering and pounding of the pipes.

While the cause may be either undersized piping, or incorrect placement of the return lines ending less than 18 inches above the water line, the complaints most frequently are solved by making certain there is adequate air elimination with air valves and controlling the boiler to assure not more than one pound of steam pressure.

See also: PLUMBING.



Servicing Your Car's Heat Riser

This frequently ignored part is usually difficult to get to, but service is simple and it can make a difference in your car's performance

ASK ANY KNOWLEDGEABLE weekend mechanic what a manifold heat control valve is, and he will respond with something like, "That's the formal term for a heat riser."

Everyone knows its name, even its nickname. Everyone knows it's there and some even know why it's there. But very few ever service it.

Yet checking and servicing the heat riser, on cars so equipped, should be part of every tune-up. The heat riser is on virtually all engines except some late models with the thermostatic air cleaner. You will even find it on some late models with thermo air cleaners.

How well the heat riser functions determines how smoothly the engine will perform during the warm-up period.

The heat riser is a valve assembly that regulates heating of the intake manifold during engine warm-up. It does this by permitting exhaust gases to flow against a predetermined hot spot joint of the exhaust manifold and intake manifold on in-line engines, and through the exhaust crossover passage of the intake manifold on V-8 engines.

When the engine is fully warmed up, a thermostatic spring (mounted externally) unwinds, and the flow of exhaust gases pivots the valve to close off the heating of the intake manifold, and prevent overheating of the air-fuel mixture.

The movement of the valve is gradual (an external counterweight keeps it from fluttering); as the engine warms up, a smaller and smaller amount of exhaust gas —and less heat—can affect the intake manifold.

Clearly, if the valve sticks in the no-heat position, the engine will sputter along until it warms up.

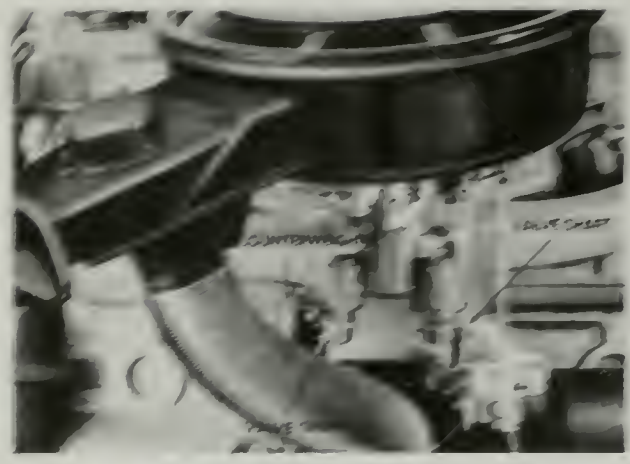
If the valve sticks in the heat-on position, the air-fuel mixture will be overheated and warm-engine performance will drop.

The valve assembly is so designed that when the motorist floors the gas pedal and the engine still is cold, exhaust gas pressure will pivot the valve slightly toward the heat-off position, permitting the engine to gulp a cold, denser air-fuel mixture.

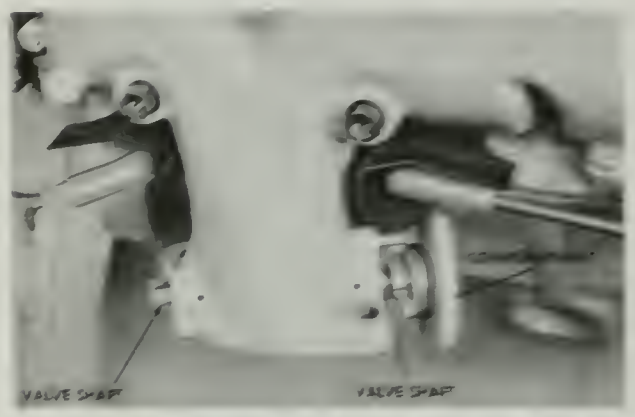
The thermostatic spring is at the rear of the exhaust manifold to keep it out of the air stream through the radiator. This permits the spring to react to the heat radiated from the engine, so it is sensitive to engine warm-up, and if it breaks, it can be replaced without removing the exhaust manifold.

The heat riser is not mounted in a par-

heavy duty drill: see drill press
heddle alignment: see loom
helmsmanship: see docking, boat
herbicides: see fertilizers



▲ The heat riser is on the exhaust manifold near the intake manifold (left on sixes and near the exhaust crossover passage on V-8s.



▲ Close-up view of heat riser valve with thermostatic spring and counterweight.

Ordinarily convenient location, which is why it is so often neglected. The photographer turning now to spray the heat riser with solvent was taken on an Olds Toronado, which is an exception.

However, you can generally get to the heat riser from underneath, and it should be checked.

A simple check doesn't even require touching the assembly. Just start the engine when it is cold, and momentarily give it full throttle. The valve counterweight should move at least a half inch and then return to its normal position.

If the heat riser passes this test, it is operating properly and requires only a preventive maintenance dousing of the valve shaft with aerosol carburetor cleaner, as illustrated.

If the heat riser fails the test, try to move it back and forth by hand (which is a good double-check even if it passes the test). Grab it by the counterweight and see if there is any binding at all. The heat riser is supposed to be absolutely free—it should be able to flop back and forth.

If it doesn't, start spraying carburetor cleaner, or an equivalent penetrating solvent, onto the valve shaft at the points it enters the exhaust manifold—if possible on both sides.

You may have to tap the counterweight back and forth with a hammer to work in the solvent and free the shaft. The job may take 15 minutes and is tedious, but the results are worth it.

The thermostatic spring should be checked with the engine cold and warm. It should be firmly against its anchor pin with the engine cold; in the free extended position when the engine is hot. P.W.

See also: AIR CLEANERS; ANTI-POLLUTION; ENGINE TUNE-UP, ENGINE.

◀ This Olds Toronado is one of the few automobiles with an easily accessible heat riser.

Plan your garden as shown here, to grow in neat rows, usually 48 inches apart, to make cultivation for weed control easy and to make routine harvesting more convenient.

Raising Your Own Herb Garden

If you enjoy the accent herbs give to foods, or if you want to attempt a profit-making venture, a knowledge of herb growing is one answer

DO YOU LIKE A DASH of marjoram or savory in your salads, a bit of rosemary or basil in your soups, or anise-flavored cookies? Then why not grow the seasonings yourself?

If you raise vegetables or flowers successfully in your garden, you can grow herbs. Those listed here grow well in moderately fertile, well-drained soil. Sandy loam soil is preferred, but fairly heavy clay soils will do. However, for best results, sage, rosemary and thyme require well-drained moderately moist locations, and parsley, chervil and mint need considerable moisture along with good drainage. All listed herbs—except chervil—need full sun.

Herbs are happy in soils that may range from slightly acid to slightly alkaline. Maintain soil fertility by annual use on each 100 square feet of about 3 pounds of a 10-6-4 or 12-6-6 fertilizer applied in one pound portions at five or six week intervals, beginning early in spring.

Annual and biennial herbs are grown from seeds sown directly in the garden in late May. The perennial tarragon is started by means of cuttings, and the mints by means of naturally-rooted surface runners or underground runners that are separated from the parent plant for transplanting. The other perennials can usually be grown from seed sown in the garden at any time from late spring until early autumn. The mulched seedlings will go through the winter in good condition to make fine large plants from the next year forward. However, many herb gardeners prefer to start perennial herbs under glass early in spring to yield sturdy seedlings for transplanting about eight weeks later, or from late May to early June. Once perennial plants have become established, the planting can be increased by vegetative means, generally rooted cuttings.

Tender perennials, such as rosemary and sweet marjoram, must be grown as annuals in northern regions where they would perish otherwise during cold winters. On the other hand, some annuals such as anise, caraway, dill, and sweet marjoram, have

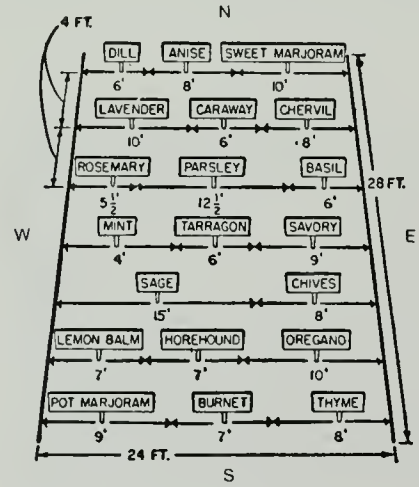
hideaway track: see model car layout
hide glue: see adhesives
hi-fi speaker: see stereo

been grown successfully as winter crops in the southwestern states.

An ordinary packet of seeds (from your local or mail-order seed dealer) is sufficient for a small test plot, and perhaps for a much larger planting. Economically-priced "trade packets" available from some dealers contain several times as much seed and may be adequate for rather large extensions of the herb gardens, whereas ounce-lots or even fractional ounces may prove to be wastefully expensive. Plants may be obtained from your favorite nursery and will provide cuttings, divisions or layers should you wish to increase your planting.

Two or three plants each of the most popular herbs may be enough for strictly family use, requiring as little as ten or 15 square feet in the garden. A separate plot is not necessary; perennial herbs may be planted in a perennial bed or border, annual types among annual flowers or vegetables. Even an ordinary window box or flower pots will supply useful quantities of herbs. Parsley, chives, pot marjoram, rosemary, thyme, mint, savory and tarragon do very well indoors.

However, our planting chart provides room for all twenty kinds of herbs listed in the numbers suggested for a pilot planting. This herb garden will provide ample fresh and dried herbs for a large family, with enough left over for gifts to friends and neighbors. With the rows spaced four feet apart for ease of cultivation and harvesting, about $\frac{1}{60}$th acre is required; three foot spacing between rows will reduce plot to $\frac{1}{80}$th acre. Note that taller herbs are located to the north of shorter kinds to avoid undue shading.



Herb planting chart.

Fresh clippings can be taken from your herb plants every two or three weeks, from the time the new growth becomes usable in June until the last tender growth in October. Remove all new growth that may be pinched off easily (from three to five inches long).

Material you do not need at the moment can be easily dried and bottled for future use. Rinse the fresh cuttings thoroughly in cool, running water. Shake herbs briskly to remove most of the moisture, then spread on clean bath-toweling or place on a three foot square of clean cheese-cloth and tie corners together. Hang bag on the clothesline. When surface-dry, spread the cuttings out fairly openly and only a couple of inches deep on two or three foot square trays made of aluminum window screening, hardware cloth or unbleached muslin, with 1½x1½-inch wide pine framing. Place in a dry, airy place out of the sun, as in a warm attic room. Elevate the trays on cornerblocks of wood or other handy objects for good circulation of warm, dry air all around.

Instead of using trays, you may merely tie clean, drip-free herbs in small bunches and hang them in an attic or barn loft. Stir the leaves on trays or loosen the bunches a little every day or so for uniform drying. When dry, they may weigh only ten percent of their original weight.

Drying without the aid of artificial heat is a slow process, however, and may take quite a few weeks. A quicker method is the

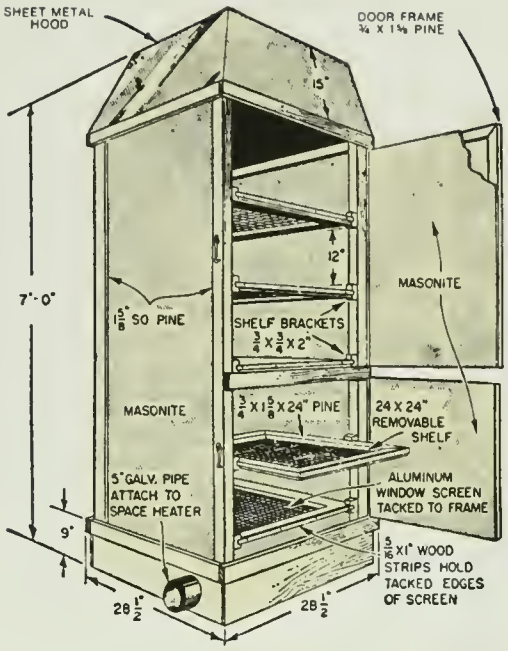
use of aluminum screening (16 meshes to the inch) placed on an over rack in your kitchen stove. Allow at least one inch along each edge of screening for air circulation, and turn wire ends under. Regulate heat as low as possible—above 100°F. in an electric stove, 125°F. in a gas stove. Set the door on the broiler-stop to permit an opening of three to five inches for constant ventilation.

Place the dried herbs in glass jars and cover partially. If drops of condensation appear inside the jars within 24 hours, return the herbs to the oven or attic drying area until completely dry.

Now strip the leaves off by hand, discarding the stems. Crumble the leaves fine by rubbing through a coarse screen, or grinding in a commercial one-cup mincer used for chopping nuts, shredding coconut and similar jobs. The tough dry leaves of sage don't respond well to screening through hardware cloth and they become gummed up in a meat grinder. If you plan to process a lot of sage, purchase a second-hand electric coffee grinder which is sufficiently serviceable for seasonal use.

Harvesting and drying seed herbs (anise, caraway and dill) requires a different procedure. Cut the flat-topped seed-bearing clusters (umbels) of anise and caraway when they have turned brown, and before any seeds have "shattered" or fallen naturally from the clusters, leaving a few inches of stem attached. Place clusters on muslin-covered screening trays (to prevent loss of seeds), and dry thoroughly, that is, three or four hours at 90° to 100°F. in the oven, or several days outside the oven. When dried, rub the clusters between the palms of your hands to separate seeds from stems and leafy matter, and screen with a flour sifter or dryer screen. Well-dried seeds can be stored in fruit jars or other moisture-proof containers, and will keep for years.

Only fresh leaves of dill are used for seasoning, but the seed-bearing clusters are



Collin drying cabinet. 3500 cubic feet of warm air is delivered per minute by a blower attachment from space heater. Moisture-laden air is regulated by adjusting a sliding cover over 8-inch vent in the top of the hood. Heat is controlled by regulating the burner of the space heater.

used either fresh or dried. Harvest the clusters when seeds are plump and firm, but before they have become brown. Clean and dry as described above.

To expand your family herb garden into a part-time business, merely extend the lengths of the rows, with only one species to each row. A ¼ acre planting will yield about 500 pounds of dried, screened herbs each season for home processing and commercial distribution.

Top quality and high yields are maintained by regular frequent harvesting; don't wait until blossoming of shoots seems imminent as some growers advise. One family makes seven or eight harvests during the growing season in their Michigan garden: however, five or six pickings may be all that's possible farther north, while many more pickings should be available farther south.

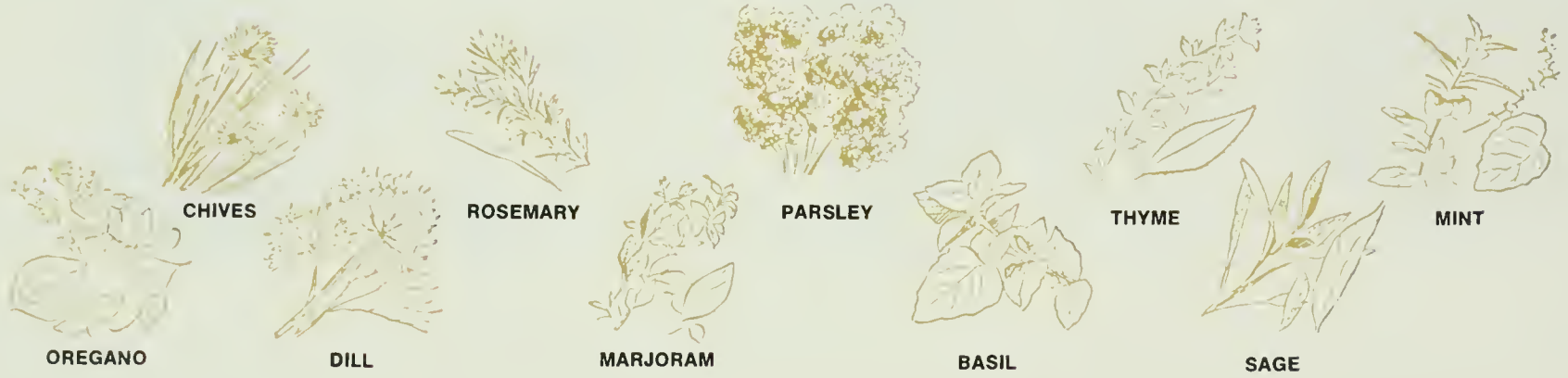
About three to five bushels of leafy

TWENTY MOST POPULAR HERBS

Name	Type	Propagation	Plant Height (in.)	Row Spacing (in.)	Pilot Planting (number) plants)	Foliage	Flowers	Parts Used	How to Use
Parsley* (Petroselinum hortense)	Hardy biennial	Seeds (sow each year)	12-15	8-10	12	Triangular, fern-like texture, rich green	Small greenish yellow, rarely observed	Leaves	Garden and pot plant; use curled-leaf varieties fresh as garnish; use more aromatic flat-leaved parsley in soups, stews, casseroles, salad, potatoes.
Basil* (Ocimum basilicum)	Tender annual	Seeds	15-18	8-10	8	Broad, oval, bright green leaves	White	Leaves	Use in cheese preparations; with tomatoes and other vegetables; in salads, casseroles, soups, stews.
Thyme* (Thymus vulgaris)	Hardy perennial	Seeds, cuttings, layers	6-8	5-6	12	Tiny, dark green leaves ⅜" long, ⅛" wide	Pink, red or white	Leaves	Use in sausage and meat loaf; with any meats (best with beef or pork); in soups, casseroles, stews; for fish and shellfish soups, clam chowder, oyster stews.
Winter Savory* (Satureja montana)	Hardy perennial	Seeds, cuttings, layers	10-15	8-10	12	Similar to thyme but slightly larger	Pinkish white	Leaves	Good with all meats, soups, stews, casseroles. Summer savory (Satureja hortensis) is an annual of faster growth and milder flavor.
Sage* (Salvia officinalis)	Hardy perennial	Seeds, cuttings, divisions	15-18	10-12	12	Long, oval, thick gray leaves	Blue	Leaves	Use in poultry stuffing and with meats; also in biscuit batter.
Mint* (Mentha species)	Hardy perennial	Root cuttings	18-20	10-12	10	Bright green pointed oval leaves 1" x 2"	Pinkish white	Leaves	Use spearmint (M. spicata) or peppermint (M. piperata) with lamb or pork, with fruit salads, in peas; in tea, hot or cold drinks and in ice cream. Peppermint is darker green with sharper, spicier flavor.
Sweet Marjoram (Oreganum majorana or majorana hortensis)	Tender perennial	Seeds	10-12	5-6	20	Broad, oval, deep green, slightly furry leaves	Pinkish white	Leaves	These are all species of marjoram that are used in food flavoring—especially with meats, poultry and most vegetables; very good with lamb. Sweet marjoram is grown more in home gardens because of pleasant odor and warm, aromatic flavor; used commercially mostly in poultry seasoning mixtures. Oregano is strongest, popular in spaghetti, pizza, meat loaf, casseroles, soups and stews.
Pot Marjoram (O. onites)	Hardy perennial	Cuttings, divisions or layers	12-18	12-18	5	Same as above	Same as above	Leaves	
Oregano (wild marjoram or O. vulgare)	Hardy perennial	Cuttings, divisions or layers	12-18	12-18	5	Same as above	Same as above	Leaves	
Tarragon (Artemesia drancuncula)	Widely-adapted perennial	Cuttings, root or crown divisions	15-20	8-10	4	Long, narrow, dark green leaves, 3-5" long	Yellow, rarely observed	Leaves	Use in all seafood dishes—broiled, stewed or baked or in salads; with chicken.
Chives* Allium schoenoprasum)	Hardy perennial	Seeds, crown division (of clumps)	10-12	8-10	6	Resembles miniature onion leaves	Prominent rosy pink	Leaves	Popular pot plant. Use fresh for mild onion flavor, as garnish; in salads and cottage cheese; use in soups, stews, casseroles and in vegetables.
Rosemary (Rosmarinus officinalis)	Moderately hardy perennial	Cuttings, sometimes by seeds	15-20	6-8	6	Small, narrow, dark green leaves	Azure blue	Leaves	Very spicy odor; use with meats, in soups, stews and poultry dressing, biscuit or roll dough.

Name	Type	Propagation	Plant Height (In.)	Row Spacing (In.)	Pilot Planting (number) plants)	Follege	Flowers	Parts Used	How to Use
Salad Burnet* (Sanguisorba species)	Hardy perennial	Seed	10-12	10-12	6	Rather round, saw-tooth	Rosy red	Leaves	Has flavor and aroma of fresh cucumber; superb in all vegetable salads.
Dill (Anethum graveolens)	Tender annual	Seeds	36-42	6-8	6	Feathery, dark green	Yellow in broad clusters	Leaves & seeds	Entire plant is aromatic. Use young leaves and full-size green seeds for flavoring; seed-bearing clusters for flavoring pickles. Use fresh or dried foliage in salads, soups, casserole dishes; particularly good on panfish but not shellfish.
Lemon Balm (Melissa officinalis)	Hardy perennial	Seeds, cuttings or layers	12-18	12-18	4	Bright green, broad oval leaves, resembles mint	White	Leaves	Use with lamb, pork, veal; in fruit salads; in tea and other hot or cold drinks.
Anise (Pimpinella anisum)	Annual	Seeds	24-30	6-10	8	Light green, feathery leaves	Whitish clusters like flowering carrots	Leaves & seeds	Use fresh leaves in salads; seeds in or on cookies.
Caraway (Carum carvi)	Hardy biennial	Seeds	30-36	6-10	8	Bright green, feathery leaves	White or yellow	Seeds	Use dried seeds in or on breads, rolls, cookies; in potato salad and cottage cheese.
Chervil (Anthriscus cerotolium)	Tender perennial	Seeds	10-15	10-12	6	Feathery, resembles parsley	White	Leaves	Use with seafoods and in salads; sprinkle over cream soups.
Horehound (Marrubium vulgare)	Hardy perennial	Seeds, cuttings, divisions	12-18	12-18	4	Broad oval; gray-green rough, hairy	Whitish	Leaves	Make into tea; use in cough syrups and cough drops; attractive in floral arrangements.
Lavender* (Lavendula spica)	Moderately hardy perennial	Seeds	24-30	12-18	10	Slender, thick, gray-green	Violet blue	Leaves	Delicately aromatic; dry flower stalks to perfume linen in the home.

NOTE: Herbs marked (*) are easiest for beginners to grow.



shoots are realized from each 100 feet of row. Thyme may yield about three bushels per 100 feet, with savory, marjoram, oregano, sage, mint and basil in ascending order of yield up to five bushels per 100 feet. A bushel of green cuttings will make about 1 pound of screened dried herb.

More professional methods will speed up the processing of herbs as your business expands. For example, a dryer similar to that illustrated will accommodate 2½ bushels at a time (½ bushel to each of five trays). The temperature of the dryer is moderated between 90° and 100°F.; maximum heat is 125°F. to avoid evaporation of natural aromatic oils. Each dryer charge becomes corn-flake crisp to the touch in about four hours. The thinner-leaved herbs such as parsley dry in about three to four hours at 100°F.; in as little as two hours at 125°F. Thicker-leaved herbs such as sage may require fully 4 hours at 100°F., about 2½ to 3½ hours at 125°F. About 12½ bushels of herbs can thus be dried daily.

To quickly separate dried seed herbs from their stems, spread 6 or 8 inches deep on a tarpaulin, or stuff in a coarsely woven burlap-bag and tie securely. Run a light roller (lawn roller) repeatedly over the loose mass on the tarpaulin or pound the plant-filled bags for a few minutes with a baseball bat. The stems and leaves act as cushions to prevent injury to the seeds. Fork off stems and leaves from the threshed seeds by hand or with a garden fork or rake.

Pour the dried seeds into a basin of clean, cold water. When seeds sink, pour off chaff with the water. Pour seeds onto a drying screen, leaving sand and other heavy refuse behind in basin. Spread seeds thinly on muslin-covered trays to dry quickly in a warm, airy room or in dryer at 80° to 100°F.

Do not try to sell anything until you are fairly sure you enjoy growing herbs and have some assurance that a demand may be stimulated for your produce, which may be more expensive to the consumer than some nationally-distributed brands. Start with individual herbs, then add special mixtures of dried herbs, or fresh herbs blended with wine vinegar, salad oils or mustard. Call on your own ingenuity and on handbooks available at your local library for other ideas.

Package your product attractively in quality-preserving containers. A one ounce (liquid measure) squat glass jar with a wide screw-top for easy spooning-out holds ¼ ounce of dried herbs. This, plus a three ounce bottle for herb wine vinegar, provides a handy introductory size. Check your classified telephone directory or inquire of your local drug dealer for convenient sources of supply.

Bring your product to the attention of the public by showing it at local fairs, donating some jars of herbs for sale at church benefits, and offering to speak before women's clubs and service clubs—at which samples may be distributed. Enthusiastic friends and neighbors who have received gifts of your herbs and herb preparations will also help build up the reputation of your product.

When local reaction confirms that you have high-quality, appealingly-packaged herb products to offer, try to induce local gift shops, department stores and supermarkets to purchase your products, or sell by mail. G.E.M.

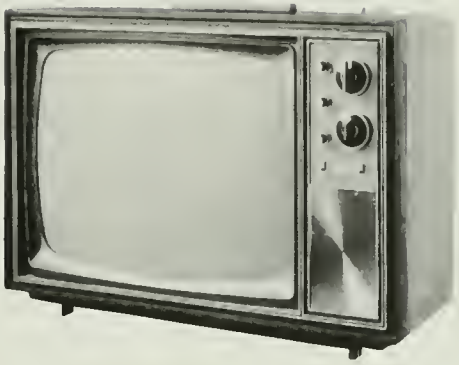
See also: FERTILIZERS; GARDENING.

WHERE TO FIND IT

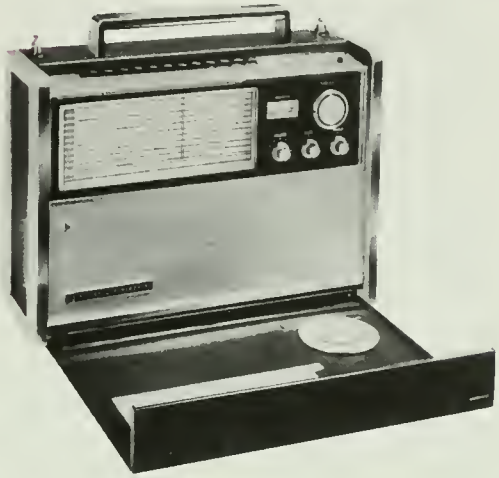
Specialized sources of herb seeds and plants include Plantation Gardens, Rustburg, Va. 24588, Village Hill Nursery, Williamsburg, Mass. 01096, Taylor's Garden, 2649 Stingle Ave., South San Gabriel, Cal. 91770.

For information about a 4-page "Herb Buyer's Guide," write to the Herb Society of America, Horticultural Hall, 300 Massachusetts Ave., Boston, Mass. 02115.

Servicing Hi-fi's, Radios and Television Sets



You can repair them yourself and save on total labor costs, or partially save by diagnosing the trouble before the technician gets there

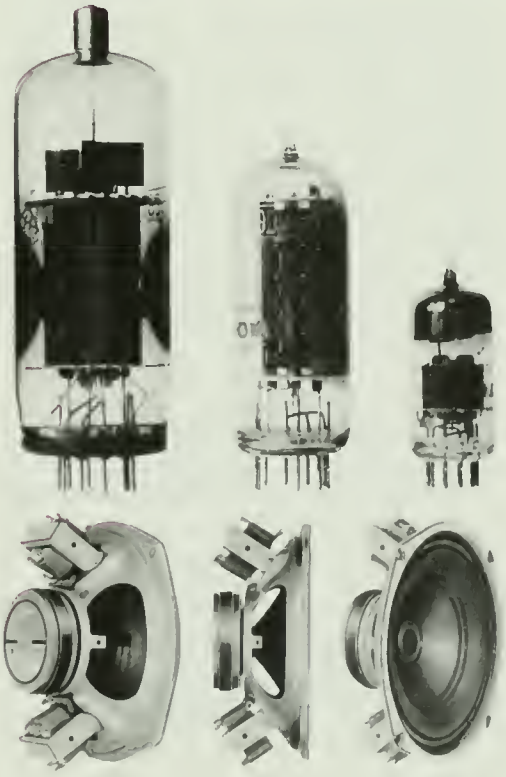


YOU CAN OFTEN DIAGNOSE and repair troubles in your radio and television receivers, or hi-fi system. There are some repairs that should be tackled only by a competent technician, but since it costs money to have a technician diagnose the trouble, it would still be cheaper if you were to do the preliminary diagnosis and perform the easy and simple repair tasks.

The only test equipment you need is a volt-ohm-milliammeter, called a VOM by engineers and technicians. It is a multi-purpose meter that will measure AC and DC volts, current in milliamperes and resistance in ohms and megohms.

AC/DC radios. Most radio sets, except transistor portables, are of the so-called AC/DC type. The AC/DC radio was devised some 30 years ago when there was a need for a radio that could be operated either from AC house current or DC power, which was still in use in some cities at the time. Today, nearly all homes and apartments have AC power and the AC/DC radio still exists mainly because it is cheaper to build, since a power transformer is not used.

Tubes don't light. In radios of the AC/DC type, the heaters (filaments) of the tubes are connected in series in Christmas tree light fashion. If one tube burns out,



high relief carving: see carving

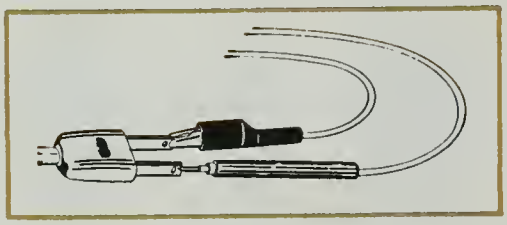
none will light. This is the most common cause of failure.

If your radio fails to play when turned on and plugged in, and no hum is heard when your ear is held close to the loudspeaker, suspect a burned out tube. If the set is left turned on for several minutes and the cabinet does not get warm, and you see no light at any of the tubes (dull red glow), the trouble can be a defective switch, broken connection at the power plug, or a burned out tube.

Disconnect the power plug and connect the leads of an ohmmeter (volt-ohm-milliammeter set to measure ohms) to the prongs of the power plug. With the switch turned on, the meter should indicate less than 1000 ohms. If it indicates that the circuit is open (meter needle does not move), examine the power plug to determine if one of the wires has been pulled loose from its prong. If this is the case, cut the cord an inch or so from the plug and install a new plug.

If this does not cure the trouble, remove the set's rear cover carefully, the chassis holding screws and the knobs, and remove the chassis from the cabinet. With the power plug disconnected, connect the ohmmeter leads to the ends of the power cord inside the chassis, and short circuit the power plug prongs with a screw driver blade with the switch in the "off" position. The meter should now indicate zero ohms (full-scale meter deflection). If this does not happen, the cord is defective and should be replaced with a new one. If the cord is OK, you are ready to check the on-off switch by connecting the ohmmeter across its soldered terminals. With the switch turned on, the meter should indicate zero ohms.

The ohmmeter is the best instrument for checking out the appliance's open line cord. Wire breaks are common. Look for weak spots in wire near chassis and close to plug.



Depending upon which is handier for you, take the tubes out of their sockets and have them tested, or use the ohmmeter to measure the continuity of the heater of each tube with the tubes in their sockets. You have to know which socket terminals to check.

The terminals may be numbered. If not, you can tell the numbering arrangements used for common types of tubes by looking at the bottom of the socket.

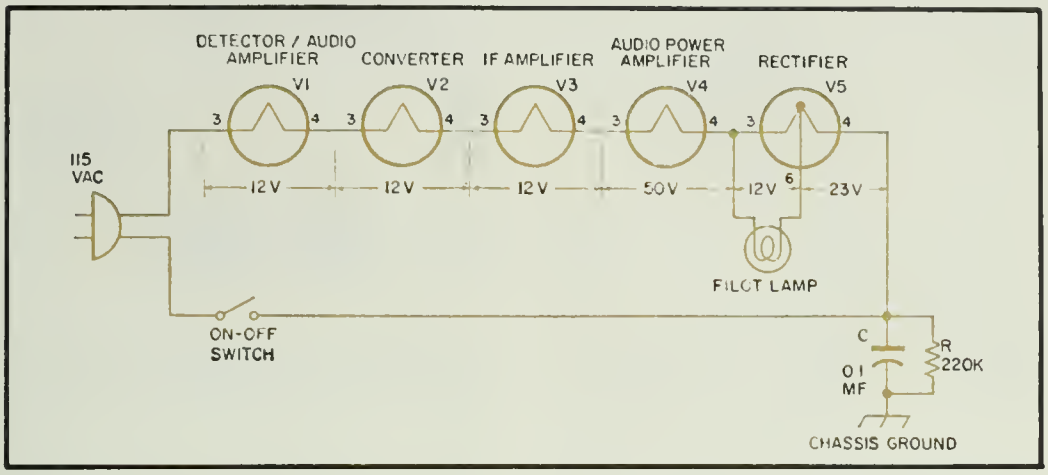
Touch the ohmmeter leads to the heater connections of each tube, one at a time. If you get an open circuit reading (meter needle does not move) at one of the sockets, the tube in that socket is apparently burned out. Replace the tube with one of the same type. Now, you should not get an open circuit indication.

Turn on the radio switch and plug in the power plug. The tubes should light and, if nothing else is wrong, the set should operate. Make sure that the set chassis does not make contact with any metallic grounded object. Do not touch the chassis unless you are standing on a dry insulated surface, in order to avoid possible shock.

To test the set while it is out of its cabinet, put the knobs on the shafts (with power plug disconnected) and touch only the knobs when adjusting the set. If it works properly, disconnect the power plug and reassemble the set.

On the other hand, if you choose to take all of the tubes out for testing, make a chart noting which tube belongs in which socket so you will know where to reinstall them after testing.

Pilot lamp. Most AC/DC radios no longer have a pilot lamp which glows when



Filament line-up for most "all American five" AM superhet radios. Pin 3, of V1 is often connected to chassis ground to keep hum voltage to V1's cathode low.

the set is turned on. When a set is equipped with a pilot lamp is is usually connected, across part of the heater of the rectifier tube. The set will continue to play even if the pilot lamp burns out since the series circuit is not broken, although slightly changed in total resistance.

The pilot lamp should be replaced only with one of the same type number as originally installed in the set by the manufacturer, usually a number 47 lamp. When the set is first turned on, the lamp may glow brightly and then dim as the tubes warm up. The resistance of a tube heater is quite low when it is cold compared to its resistance after it has reached operating temperature.

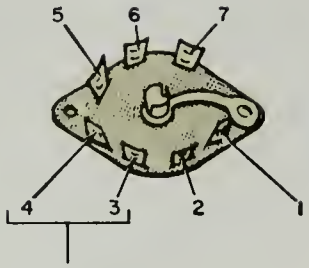
Tubes light—set doesn't play. While a burned out tube is the usual cause of trouble, there are many other defects that can prevent a radio from operating. A tube can be defective even if not burned out. So, have them tested and replace any bad ones.

If the tubes light and the cabinet gets warm, listen for a slight hum in the loudspeaker. If none is heard, disconnect the power plug and pull the chassis. Momentarily connect a 1.5-volt flashlight cell across the speaker terminals. A click should be audible as the battery leads touch the speaker terminals. If no click is heard, the speaker voice coil circuit is probably open and the speaker should be replaced with one of the same physical size and impedance rating.

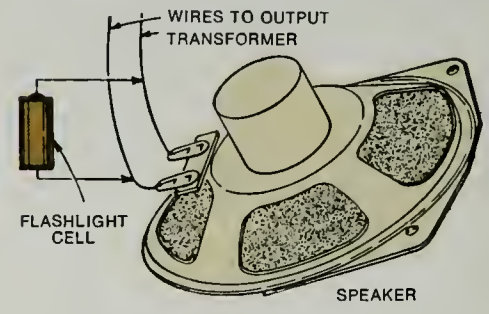
Presence of hum indicates that the speaker is live and that the trouble is elsewhere. With the chassis out of the cabinet, the power plug connected, the switch turned on, and the volume control set wide open, touch a test lead (not connected to anything) to the center volume control terminal. A buzz should be heard. If not, the trouble is in the audio section of the receiver, in any one of the many components, including either of two tubes.

Among the possible troubles in the audio section are an open coupling capacitor from the plate of the first amplifier tube to the grid of the audio power amplifier, a shorted capacitor across the primary of the output transformer or an open first amplier plate resistor or open power amplifier resistor.

A buzzing sound caused by touching a test lead to the center volume control terminal indicates that the trouble is ahead of the audio amplifier. If the set cannot be made operative by replacing one or more



Bottom view of a 7-pin miniature wafer socket. Printed-circuit sockets are similar.



An ohmmeter, or leads connected to dry cell, will make a "good" speaker thimp or click.

tubes, further diagnosis should be made by a technician, unless you want to attempt it yourself. But, do not touch the IF transformer alignment screws since you will need a signal generator to get them back on the correct frequency.

Look for a charred resistor and for swollen capacitors or chemical oozing out of a capacitor and replace such components with exact equivalents. In the case of a charred resistor, a capacitor in the same circuit may have blown causing the resistor to overheat.

Excessive hum. A loud hum may be caused by a shorted tube or a dehydrated filter capacitor. The set may or may not play. The first step is to test the tubes and replace defective ones. If the hum persists, chances are the filter capacitors need replacement. Note the ratings marked on the filter capacitors and buy an exact equivalent. Unsolder and remove the old ones and install the new ones, being careful to observe color coding or polarity marks. If this was the cause, the hum should be gone or diminished. After the set has been played a while, the hum may get weaker as the capacitor forms.

Distortion. Highly distorted sound, often accompanied by hum, is often caused by a shorted tube or electrically leaky coupling capacitor between the plate of the first audio amplifier and the grid of the power amplifier. Disconnect the old one and solder in an exact equivalent. At the same time, as added insurance, replace the capacitor between the plate and screen of the audio power amplifier tube (bridges output transformer primary).

Lack of sensitivity. Inability to pick up as many stations as in the past may be due to aging tubes, dehydration of filter capacitors or change in the characteristics of a resistor or capacitor. Test and replace weak tubes first. If the set hums, replace the filter capacitors. These steps usually restore performance. Further diagnosis should be made by a technician.

Fading. The sudden rise or fall in the volume of a radio is often caused by inadequate pick up by the built-in antenna. In some cases, the volume drops or falls when a light switch is turned on or off. The lighting circuit changes its characteristics as a switch is opened or closed, and may reinforce or attenuate the level of the signal reaching the radio's antenna. The simplest cure is to move the radio to another location in the room, or to re-orient it to change its antenna position with respect to the stations to be received.

A loose connection inside a tube or capacitor can also cause sudden changes in volume. Slow fades on all stations are generally caused by a tube with an intermittent heater. Fading of volume when listening at

night to stations more than 50 miles away, but with nearby programs remaining steady, is due to cancellation of the ground wave radio signal by its sky wave, which is not the fault of the radio.

Transformer type radios and hi-fi tuners. Nearly all hi-fi radio tuners and some radio receivers employ power transformers, particularly those inside of large console cabinets, and particularly those that were manufactured several years ago. In these sets, the tube heaters are generally wired in parallel and the plate and screen voltages are usually much higher than in AC/DC radios.

Tubes don't light. Failure of the pilot lamp to light when the tubes light is generally due to a burned out pilot lamp. Failure of all the tubes to light is most often caused by a blown fuse, if the set has a fuse. Generally, the fuse is at the rear of the chassis and can be replaced by merely turning the fuse holder counterclockwise and pulling it out. It can be checked with an ohmmeter to determine if it is open, if it is not obvious when looking at it that it is burned out. Replace the fuse only with one of the same type and rating as specified by the manufacturer of the set.

Should the fuse blow when the set is plugged in and the switch is turned on, there is trouble inside the set.

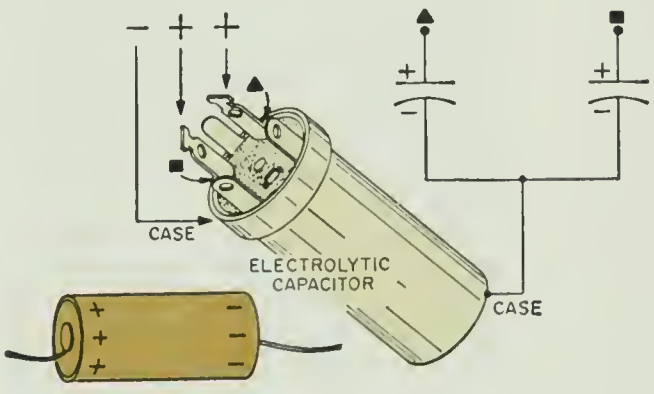
If the fuse is all right, or a new fuse does not blow, pull out the power plug and connect the ohmmeter leads to its pins with the radio switch turned on. If an open circuit condition is indicated, inspect the power plug connections to the cord and replace the plug if one of the wires has pulled loose from its prong. Pull the chassis if the trouble is not at the plug.

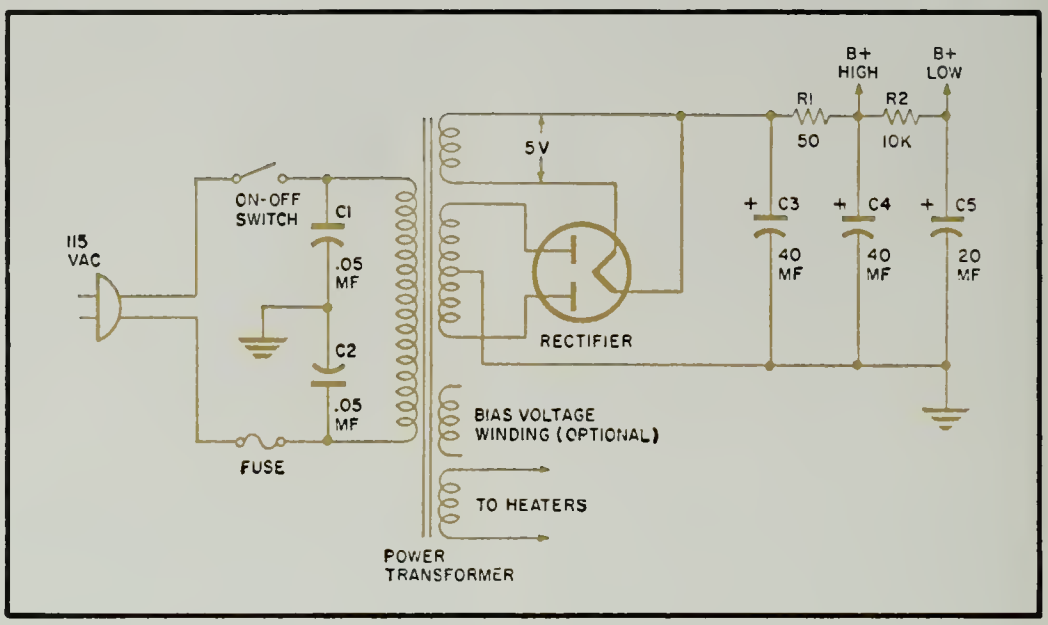
Touch the ohmmeter test leads to the ends of the power cord inside the chassis and short the power plug prongs with a screw driver blade with the switch in the "off" position. You should get a short circuit indication. If not, replace the cord and plug. Now, check the switch with the ohmmeter. A short circuit (zero Ohms) condition should be indicated when the switch is in the "on" position, and open circuit when in the "off" position.

Then connect the ohmmeter leads to the power transformer primary leads. One is usually connected to the fuse (or to one wire of the line cord when there is no fuse), and the other to one terminal of the switch. An open circuit reading indicates that the power transformer primary is open, which means that the transformer must be replaced by an exact equivalent.

New fuse blows. Blowing of a newly installed fuse of the proper rating usually indicates that there is a short circuit within the set. If the set is connected to an external ground, remove the ground connection. Now, if the fuse does not blow when the set is plugged in and turned on, chances are that one of the line filter capacitors is shorted. Disconnect the power plug and touch one ohmmeter test lead to the chassis and the other to either power transformer primary lead. You should get an open cir-

Electrolytic capacitors are of two basic types. Tubular units (extreme left) and miniature units for transistor circuits usually have wire leads. Can types may have one, two, three or four sections. The can does not have to be grounded—it can be mounted on a phenolic wafer and be "hot." Cardboard-sleeve insulators are often left off during replacement.





Typical full-wave rectifier circuit, used in vacuum-tube hi-fi, is just about identical to those used in first transformer-powered radios more than 30 years ago.

cuit indication. If not, replace the line filter capacitors with new ones of equivalent value and rating. However, if you still get other than an open circuit reading, the power transformer primary winding may be grounded to its core and replacement of the transformer is indicated.

Trouble on the other side of the power transformer, which causes the fuse to blow, could be due to a short or ground in one of the transformer secondary windings, or a short circuit or ground in the tube heater winding. Pull out the rectifier tube and turn the set on. If the fuse does not blow now, but does blow when the rectifier tube is reinstalled, the trouble is probably due to a shorted filter capacitor.

The shorted filter capacitor can be identified by measuring the resistance with an ohmmeter from the hot terminal of each filter capacitor to the chassis. Sometimes two or more capacitors are inside the same container. If a very low resistance or short circuit condition is found, disconnect the wire at the capacitor terminal and check it again with the wire removed. If the short isn't cleared now, replace the capacitor with an equivalent type. Observe color coding or polarity marks.

Tubes light—set doesn't play. When the tubes light, but the set is inoperative, any of dozens of components could be defective. If there is an odor and the power transformer gets hot, it could be transformer trouble or a short circuit elsewhere. Look at the rectifier tube for reddening of its plates which is indicative of a shorted filter capacitor.

On the other hand, if the set does not give off an odor and does not seem to overheat, the trouble could be a defective tube. All should light. The light in some may be difficult to see. After the set has been turned on for a while, all tubes should feel warm to the touch. Nevertheless, have all the tubes tested and replace any defective ones. Check the loudspeaker as explained earlier about AC/DC sets.

Other troubles, such as hum, distortion,

lack of sensitivity and selectivity, and fading can be due to the same causes as explained earlier, regardless of whether the set is of the AC/DC type or transformer type.

Hi-fi amplifiers. The power input circuits of hi-fi and other audio amplifiers, as well as AM/FM tuners, are similar to those of transformer type radios and the same check-out procedures can be used.

Excessive hum. Some amplifiers are equipped with a hum control at the rear or top of the chassis which can be adjusted with a screwdriver. With the volume control turned to minimum volume, adjust the hum control slowly for minimum audible hum. If the hum cannot be reduced to a satisfactory level in this manner, have the tubes tested and replace any defective ones.

The audio power amplifier tubes may have to be closely matched in order to minimize hum and distortion. When buying new tubes, have them checked and take those which check most alike.

While it may not be specified in the user instruction book, a ground connection may reduce hum level. Get a ground clamp and fasten it to a freshly cleaned spot on a cold water pipe and run a wire from it to a screw on the chassis. (Do not do this if the amplifier is of the transformerless type).

The hum could be caused by dehydrated filter capacitors. This can be checked out by turning the chassis over to gain access to the wiring. Take a 20-ufd, 450-volt tubular electrolytic capacitor and temporarily bridge it across each filter capacitor or section, one at a time, making sure that the positive (+) terminal of the test capacitor is connected only to the positive terminals of the capacitors in the amplifier, and note any reduction in hum. Be careful to hold the test capacitor by its insulated housing and avoid touching any of the wires, terminals or test capacitor leads, to avoid shock.

An appreciable reduction in hum level, when the test capacitor is tried, indicates that the filter capacitors should be replaced.

Hum, which increases in intensity when the volume control is turned up, in any position of the function selector switch (phono-tape-tuner, etc.) indicates amplifier trouble. It could be an improperly seated tube shield or a defective tube.

However, if the hum rises when the function selector switch is set to one particular position, the trouble could be in the particular pre-amplifier selected, in the lead from the selected input device (tuner, record player), or in the input device itself.

Check the amplier input lead and plug, looking particularly for a broken shield at the plug at each end of the lead. Make sure that the plugs are firmly seated in their sockets.

When separate line cords are used for each hi-fi system component, try reversing the positions of their respective power plugs in their sockets.

Record changers. A record changer is an intricate and touchy mechanism which should be adjusted only by an expert. However, it can be lubricated by anyone who has available an instruction book spelling out when and where to lubricate and what kind of lubricant to use.

Rubber rimmed drive wheels and idlers wear out and cause rumble. Replacements can be purchased at radio parts stores. You can install them, if you exercise care not to disturb other parts of the mechanism.

The stylus of many types of stereo and mono cartridges can be easily replaced. The new stylus is generally furnished with specific installation instructions. Sometimes it is necessary to replace the entire cartridge, or you may want to replace your cartridge with one of a type more suited to your requirements.

Portable transistor radios. Servicing portable transistor radios is a job for an expert with the proper tools, test equipment and spare parts. The most common trouble

is worn out batteries, which you can easily replace. Symptoms of worn out batteries are lack of volume, a motorboating sound or a rapid fade out shortly after switching on.

Replace the battery or batteries (all of them at once) with exact equivalent types, being very careful that the new ones are inserted or connected in the same polarity as the original ones. If necessary, clean the contacts with a pencil eraser and bend the clips slightly to ensure firm contact.

Television sets. Numerous books have been published about how to repair your own TV sets. While many professional TV service shops have initially lost business as a result, they have gained additional revenue undoing the damage done by some do-it-yourself TV owners.

When your TV set acts up, it will cost you several dollars to get a pro to come to check it over, quite a few dollars to get it repaired if more than a new tube is required. Some shops charge a minimum to look over your TV set even when you bring it to the shop.

There are several things you can do before you call in an expert. Before touching the TV set, as long as it is operating, even if not satisfactorily, check out the antenna system. Look for loose, bent, broken and corroded elements and carefully examine the connections to the twin-lead transmission line. If the antenna has been in use more than five years, it might be a good idea to replace it and the transmission line, which gradually deteriorates, downgrading reception as it does. Also check the antenna connections at the set.

No picture—no sound. Sudden failure of a TV set to operate is usually due to a burned out tube or fusible resistor inside the cabinet. The first step is to remove the rear cover. The power cord is automatically disconnected when the cover is removed.

Before you take out the tubes for testing, look for the label that shows the locations of the various types of tubes. If there is not a label, make one noting the locations of the tubes and the number of each tube as you remove it from its socket. Have the tubes tested and replace any defective ones.

Many TV sets have their tubes connected in series as in AC/DC radios. Hence, one burned out tube can prevent the others from lighting. Also, the fusible resistor in such sets, if burned out, can prevent the tubes from lighting. Usually, the fusible resistor is a two-wire plug-in device which can be pulled out of its sockets and replaced with a new one of the same value. You can check it with an ohmmeter.

Picture troubles. Vertical and horizontal picture instability can often be corrected by adjustment of the horizontal and vertical controls. Sometimes, replacement of a weak tube will cure the trouble. Absence of a picture, but with the screen lighted, is often caused by a defective tube. Unclear pictures and ghosts are usually caused by antenna trouble, improper tuning and antenna orientation.

Sound troubles. One of the troubles is buzz in the sound which can be due to any number of causes. A screwdriver adjustment is provided in some sets which is set for minimum buzz. There is also a tuning slug in the gated beam detector coil which can be adjusted with a special tuning wand. But, both of these controls are usually inaccessible unless the rear cover is removed, and adjustment cannot be made satisfactorily unless the set is turned on.

Tuner troubles. After a few years of use, the contact points inside the tuner (controlled by channel selector switch and fine tuning knob) get dirty causing unstable picture and sound. You can get a can of TV tuner cleaning fluid which you can spray into the tuner through the holes, with the set's rear cover removed. Rotate the channel selector knob as you spray.

See also: COLOR TELEVISION; ELECTRONICS; TELEVISION REPAIR.

Making the All-purpose Back Pack

You can put together a versatile pack that will probably last for the rest of your camping career

Pack outfit used for pack, bedroll and axe.

IN THE PAST twenty years, manufacturers have made great strides in developing camping equipment that can transform an amateur into an expert overnight. Without this equipment, many current wilderness enthusiasts might never have set foot in the back-country.

While there are many advantages to the new ultra-lightweight tubular aluminum pack frames with fitted nylon pack sacks, most veteran campers are still using the back pack outfit they put together years ago.

There are several reasons why they have not switched. One is cost. Why spend $30 to $50 when the older but satisfactory models run only $12 or $15 new.

A second consideration is versatility. Without any additional equipment, these setups will adapt to packing big game, hauling water or firewood, or carrying anything else that can be lashed on a person's back. It also provides a "day pack" for side trips, hunting, fishing, and mountain climbing.

A final advantage is durability. Fully loaded, it can withstand a considerable drop without damage to the pack outfit itself (not guaranteeing the eggs and cameras inside). It can be quickly broken down into two or three units for fitting into a truck or boat, or for packing on a horse. It can be lain on and stomped on with impunity.

These are the basic components you will need to make this type of pack. First, a fiber or wood pack frame (available military surplus), with four hooks on a side. Measurements could be 15½x25-inch with the hooks about 5½ inches apart. A taut piece of canvas cushions the board from the user's back, and a hand hold is cut near the top of the board. You can add a tumpline for periodic relief when carrying heavy or bulky loads that place the center of gravity back away from the shoulders.

Next, buy a canvas pack sack, 16 inches high, 14 inches across and 7 inches deep

hiking shelters: see survival
hitch, trailer: see trailering
home additions: see additions, home
home electrical systems: see electricity
home heating systems: see fuels

with six D-rings on a side (three on the front seam, three on the back seam) and a full flap with a pocket for items needed on the trail (film, maps, toilet paper, etc.). This style pack was once known as "The Katahdin," but D-rings can be sewn to any pack of this size, preferably canvas for its resistance to abrasion and tearing.

Next on the list is cotton sash cord, $\frac{5}{16}$-inch thick by 36 feet long. Hemp is too stiff, and nylon is too slick and stretchy. This can also double for the ridge of a lean-to.

Your bedroll should be wrapped in a nylon poncho which can be used as a ground cloth and/or lean-to. Tie it with a manty or bundle knot, using one end of the sash cord. (Use only loops and half-hitches throughout this lash-up. Someone should be able to stand on the loose end of the rope while you are doing the entire job.)

Tie on the bedroll. Hook the rope from the final hitch on the bundle knot over the second hook from the bottom on the right side. Crisscross once each way and half-hitch back into the original hook.

Set the pack sack on top of the bedroll. Lay the rope up the right side of the pack and pull loops through the D-rings. Place the loops under the hooks and pull the rope snug.

Carry the rope across the flap and lash down the left side in the same manner. Pull the end snug. Bring the end of the rope back across the bottom of pack and tie into the second hook from the bottom again, or to the loop of the hitch that holds the bedroll to the frame. To remove the pack, merely untie the final knot, release the loops from hooks, and pull the end of the rope. It shouldn't take over ten seconds. By the same token, should the load loosen slightly on the trail, a couple of tugs on the rope and a new half-hitch will take up the slack.

Now, swing into the harness and take off! It may be useful to carry a small poll axe under the ropes on one side. If the trip requires a lightweight tent, it goes under the ropes on the other side. An extra jacket can be carried under the flap of the pack-sack. On a cargoing trip, additional gear can be rolled, bent around the top of the pack, and lashed under the ropes.

To make a day pack, hunting or fishing pack, or the mountain climber's assault pack, lace the D-rings together with shoe-strings or whang-leather. This pulls the load close to your back. For climbing, a piece of webbing can be attached to the lower D-rings and buckled around your belly.

When water must be packed, a five-gallon collapsible polyethylene container can be crushed under the pack when it is tied on. The lash-up is improvised to fit the cargo. A load such as this is awkward, at best, since the weight rides far back. Here the tumpline is invaluable, especially in rough terrain.

Note how the five-gallon water container rides awkwardly and a tumpline is used.

See also: CAMPING; CAMPING EQUIPMENT.

The components you will need are a fiber or wood pack frame (available at military-surplus stores) with four hooks on a side. Next, a canvas pack sack with six D-rings on a side and a full flap with a pocket for small items. Last on the list is a length of cotton sash cord 5/16-inch thick by 36 feet long.

Set the pack on top of the bedroll; lay the rope up the right side of the pack and pull the loops through the D-rings. Place the loops under the hooks and pull the ends of the rope snug enough to hold the pack firmly in place.

Carry the rope across the flap and lash down the left side in the same manner. Bring the rope end across the bottom of the pack and tie into the second hook from the bottom again, or to the loop that holds the bedroll down.

To tie on your bedroll, hook the rope from the final hitch on the bundle knot over the second hook from the bottom on the right side. Crisscross once each as shown, and half-hitch back into the original hook.

When water must be packed, a five-gallon collapsible polyethylene container can be crushed under the pack when it is tied on. This load is awkward, and a tumpline is invaluable in managing it. Other cargoes, such as trophy heads or meat, firewood, etc., can be handled with the same gear, but the lashup must be improvised to fit the load.

Making Your Own Pack Frame

Custom-build this frame to the exact dimensions of your physique for much less than one made commercially

THIS PACK FRAME IS modeled after those built years ago when money was scarce and commercially made semi-custom frames exceeded the average camper's budget. These same frames, after carrying tons of gear over countless miles, are still in regular use by the old-timer campers.

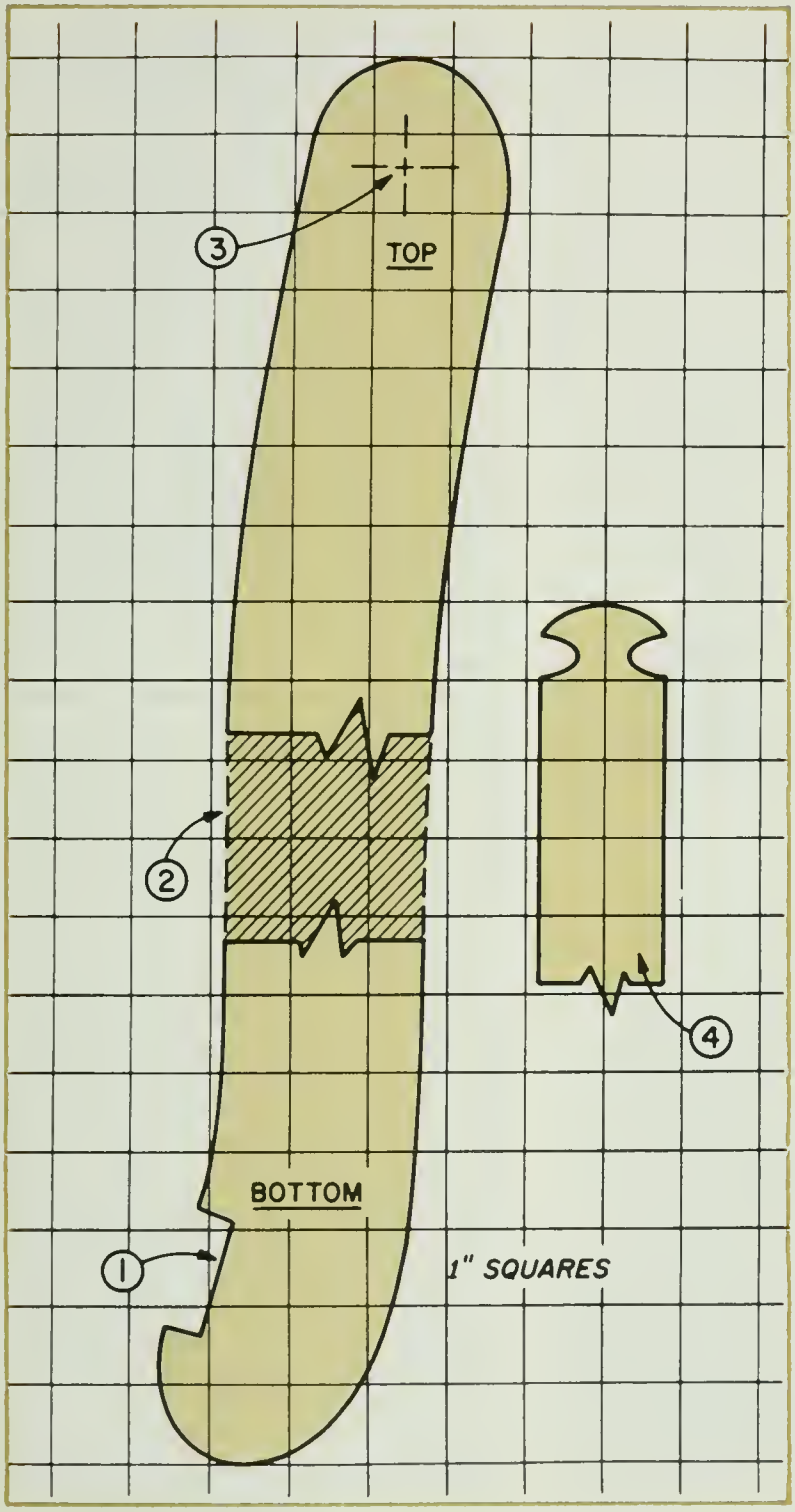
Invest a few dollars for materials, a few hours of your time, and you can duplicate this frame for yourself and, if you wish, each member of your family.

Materials needed include ½-inch thick lumber, preferably white ash or good quality marine plywood; a length of ½-inch hardwood dowel; a dozen #8 x 1½-inch flat head wood screws; eight #8 x ½-inch round head wood screws; a pair of heavy webbed straps at least 1½-inch wide and five to six feet long with buckles at one end; two 3½ to 5-inch wide burlap furniture webbing bands with a pair of grommets in each end and eight to ten inches longer than the width of the frame you are building; a length of $\frac{3}{16}$-inch nylon rope; some waterproof glue; and a small quantity of deck enamel or spar varnish. A trip to the lumber yard, a hardware store, an upholstery shop and a military surplus store should easily fill out your shopping list. Some of these items may be found lying around your home or workshop.

Tools you will need are also readily available. A saber saw, jigsaw or bandsaw to cut the necessary curves; a small hand or power drill to make the necessary holes; and a hammer and screwdriver to assemble the frame.

Dimensions for each frame are taken directly from the individual for whom it is being made. The proper length is the distance from a point approximately midway up the back of the head to a point on the rump level with the hip pockets on a pair of trousers. The width is the distance between the shoulder blades plus five inches. The five inches will allow for the thickness of the side pieces plus the lashing notches on the crossbars, and place the vertical sides about one inch outside the shoulder blades. Be sure that the individual is standing comfortably and is relaxed as the measurements are taken.

Length of the frames will vary little for



◀*Transfer the design to heavy paper ruled into one inch squares and cut it out for use as a template, than trace the shape onto the wood. 1 is the notch for the bottom crossbar, and is 1-1/2-inch long by 1/2-inch deep. 2, shaded portion of drawing, is straightline part of frame. 3 is center of hole for hardwood dowel. 4 is pattern for crossbar lashing notches.*

people of similar height, but widths can vary greatly with differences in physique.

Having established the dimensions of the frame, you are ready to start building. Begin by transferring the design illustrated to heavy paper ruled into one-inch squares. You will notice that the side pieces are made up of three distinct sections, a curve at the top, a curve at the bottom, and a straight line in between. The curves will remain the same despite the size of the frame, adjustments in length being made by varying the length of the straight line portion. Notches for top and middle crossbars have been left out of the design because their locations will vary according to the size of the frame. Add them to the design now. The top bar is located level with the shoulders and the middle bar is halfway between the top and bottom crossbars. All notches will be 1½ inches long by 1½-inch deep.

Cut out the transferred design and trace it onto the wood. To save time and ensure both sides being exactly alike, you may want to tack two thicknesses of lumber together and cut both to shape at once. Also, locate and drill the dowel holes at this time.

Crossbars are made next. Three pieces of ½-inch wood, 1½ inches wide and as long as the total width of the frame are required. Cut them to size and transfer the design for the lashing notches to the slats as you did the curve for the side pieces. Shape the notches, and they are complete. Cut the dowel to the same length as the crossbars.

You now have the six wooden pieces of the frame, two side pieces, three crossbars, and a dowel, cut to size and shape. Sand them thoroughly and tack the frame together with light wire nails. This will hold the frame together while you drill the holes for the screws which will fasten the crossbars to the side pieces. Drill and countersink the holes for your flat head screws, two at each joint. When all holes have been drilled, remove the nails, spread glue on the joints and reassemble the frame using screws as fasteners. Drive the dowel carefully through the holes in the top of the frame and glue it in place with its ends protruding one inch on either side of the frame. The dowel will add an extra measure of rigidity. When the glue has dried, sand the frame lightly and apply the spar varnish or enamel finish.

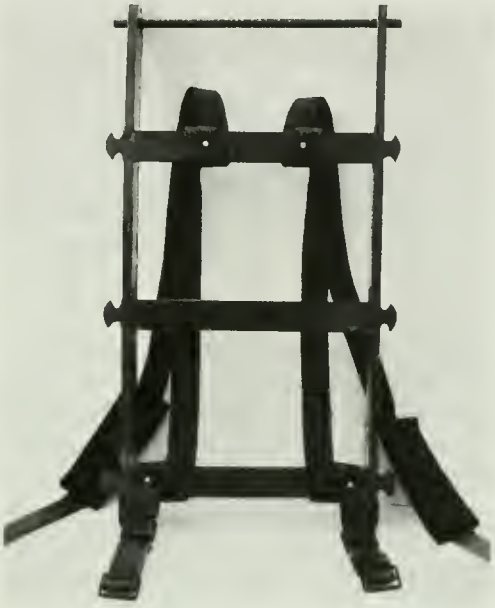
Look carefully at the picture of the frame with shoulder straps installed. This will show you how to attach them correctly. Notice that each strap is one continuous piece and, when buckled, will form a loop about the frame. Bear in mind that the straps will be lifting and supporting the frame, and that the end with the buckle and the end which passes over the shoulder must both come from beneath the crossbar to provide lift and support. The distance between the shoulder straps passing over the shoulders should be a little more than the width of the neck where it joins the shoulders. The easiest way to ensure comfort is to try the straps before they are fastened securely. When you are satisfied with the fit, fasten them permanently with the round head wood screws.

To complete the frame, lace on the burlap bands with the nylon rope. The upper band should be placed immediately below the level of the top crossbar, while the lower one should lie immediately above the bottom bar. Test the frame for comfort, shifting the bands' locations until it suits you. These bands will tend to stretch somewhat in use, particularly if they become wet. Tighten them only if the pack becomes uncomfortable. Loosen them again when the pack has an opportunity to dry; the bands may shrink and damage the frame if this precaution is not taken.

Try the frame on. Adjust the shoulder straps so that it rides high and comfortably. Make any last-minute changes in the strap

Materials for custom frame include side pieces and crossbars cut from plywood, dowel, straps with buckles, webbing bands, rope and wood screws.

Assembled pack frame. Note installation of shoulder straps.

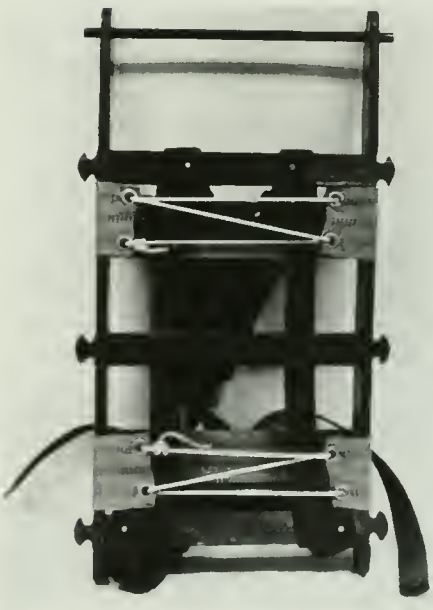


or band arrangement to suit your physique and ensure comfort. Now you are ready for your test run.

Carrying your gear on the frame is no problem. There are several methods available. A regular pack bag or even a small duffel bag can be attached to the frame. Some people use lightweight plywood boxes, pack baskets, and even square-conered plastic wastebaskets. One method is to simply fold the gear into a sleeping bag, wrap this up in a lightweight tarp or poncho, "Christmas package" style, and lash the whole bundle to the frame with a diamond hitch. This arrangement has the advantage of being adjustable as the load size varies, it's neat, and incorporates a groundsheet or even shelter into the pack itself.

If you have measured accurately and built carefully you have a frame which will give many years of comfortable service.

See also: CAMPING; CAMPING EQUIPMENT.



Completed frame, ready to pack. Note lacing of webbing bands.

Packing Your Back Pack

You can save time and energy in packing and unpacking, if you pack-up by a practical method the first time

Using a Himalayan 10 expedition pack and frame with a top extension allows the hiker to carry sleeping bag at top. Tent and ground pad are at bottom.

GOOD MODERN PACKS offer such flexibility that beginning hike enthusiasts often find themselves at loose ends, not knowing what to do come pack-up time. This problem is easily solved.

Open mindedness in your pack organizing is the only hard and fast rule; of basic importance is a compromise between weight distribution and accessibility.

For some time the popular technique in the U.S. called for keeping weight as high and as close to the body as possible. This was especially true with shoulder load packs. The hip belt has reduced the difference between high and low weight loads except in ticklish situations such as mountain or other rugged terrain where the heavier items located higher can more easily throw you off balance. But it is still vital to keep the major weight items as close to your back as possible.

Obviously, sharp-angle items close to the frame and back must be padded (use camp moccasins and clothing for the job). The popular concept of locating the down sleeping bag beneath the ¾ pack sack is debatable. Even in its stuff bag, the sleeping robe crushes against wet or rocky ground each time you remove the pack and set it down. With some equipment it is possible to stuff the sleeping bag into the center of the rolled pad which is loosely coiled in a stuff bag. Thus protected, the entire bed roll may be carried in any preferred position on the pack. Foam sleeping bags, of course, eliminate many of these problems.

The rest of the load is fairly evenly distributed within the pack, a slight edge often given to the "weight high" concept. Balance in the outside pockets should not be overlooked. Water-filled canteens are chief villains in upsetting weight balance.

After several trips you will discover various small items find homes in particular pockets. Strive always to keep them in the same place. Food is the major bulk item and should be handled as follows:

Work from two or three plastic bags. A day's food ration is separated from the rest of the larder. The main food bags are

relegated to mid pack somewhere, while the day's rations go near the top with the mess kit in one inside corner. In the opposite corner, near the top, go the stove and fuel can.

Below the main food cache (on the bottom), go spare clothes. Acting as a buffer, between the aforementioned top items, goes a down vest with a little gooseneck flashlight safe from breakage in its folds.

In hot weather keep at least one canteen inside, insulated by the down; otherwise they go on the outside. When several people are hiking together, certain loads are broken up; for instance, one person carries all the cooking pots.

In the most easily accessible top flap pocket go raingear and clean socks (dirty socks in a plastic bag if you cannot wash and air them out tied to the pack frame). Also, fit a plastic trash bag (for food wrappings, etc.) in this pocket along with toilet tissue, foot powder and other items.

For the trail carry high energy snacks in one upper outside pocket. You should fill other pocket space according to your hobbies. A good deal of room goes to photographic equipment, one long compartment nicely handling a mini-tripod.

Interior pack architecture varies from a single open space to pocketed space to zippered-off compartments dividing the bag into two or more sections.

In action, the properly organized pack is a mobile thing. As you travel, food is once a day transferred from the stock bags to the working bag. Clothing is shifted to accommodate weather conditions. Though lightweight raingear should be handy if the weather is steadily poor, keep a nylon or plastic tarp on top of the load to pull out for a quick shelter at rest stops. If you have no poncho or pack cover, try to encase most of the highly perishable equipment inside this tarp in the pack when heavy rains persist.

What-to-bring check lists are available from many sources, but in choosing your clothing consider this. Probably the most vital items include ample socks, top quality rainwear, camp moccasins or loafers, one warm vest, jacket or sweater (even if it's in the 90's when you leave on your trip). Do not burden yourself with as many clothing extras as you can jam in. You will wash clothes on a trip and you are not bucking for the Mr. Clean award on any back pack journey. J.G.

See also: CAMPING; CAMPING EQUIPMENT.

Women will probably find it more comfortable using a 3/4 length pack.

Side pockets of either pack are used for small, often used items such as camera gear. High-energy trail foods also go in easy-access pockets.

A New Face for Your Old Home Front

These easy-to-build and install home fronts can add to the value of your home

REAL ESTATE AGENTS indicate that designing a new "face" for an old home may increase its value. It will certainly be easier to sell.

The low-cost design improvements shown here provide considerable latitude —they may be used singly or combined with each other, as long as the selections harmonize with the architectural style of the house. Dimensions given may also be altered to suit. To simplify construction, specified thicknesses and widths are confined mostly to standard mill runs which need be cut to length only.

Fences and gates. To make sure any fence or gate design you select will harmonize, it's a good idea to sketch or paint it on a photo of your house beforehand.

Picket fences are old favorites, particularly for colonial-style homes. Rail fences, which are easier to build and care for, run a close second. The louver fence, increasingly popular, can be built in sections to screen off entrance doors from the street, or unattractive parts of the yard.

The basket-weave, a relative newcomer, is also finding favor rapidly. You can make it with posts spaced up to eight feet apart and adjacent rails crisscrossing to opposite sides of posts. Posts should be imbedded in concrete—at least 18 inches below grade if for a fence three feet high, and two inches more for each additional foot of height.

Fencing should be kept well painted. A good grade of pine will do for all parts except the posts, which ought to be redwood or cypress. Before installing, treat below-ground sections of posts with two or three soaking coats of creosote.

No fence is complete without a suitable gate. One of the most substantial is the solid colonial type made up from three ¾ x 11½-inch boards (known as 1 x 12s in dimensional size). To assemble, glue-join the boards with a waterproof adhesive. Cut the facing boards for each side out of ¾ x 4⅝-inch stock (1 x 5s), except wider pieces at the bottom which could be ¾ x 9½ inches. If possible, use a shaper to make the stop-chamfers. Apply framing on one side of the gate with four penny coated common nails, then turn up other side and frame with six penny nails.

Prepare a cardboard template from graph squares to scribe cutting line for the pediment and cut with a band saw or coping saw. Shape the fillet, cap and

home intercom system: see intercoms

Archway with recessed gate.

turned finial, and install. Many lumber yards will furnish the finial if you do not have a lathe to turn it out yourself.

The archway-gate goes hand in hand with a picket fence. Assemble posts, stretchers and lattice strips. Cross-brace the front and back posts until unit is cemented into the ground.

Prepare two laminated sections for the arch, using ¾-inch stock. Join segments with waterproof adhesive and four penny

FIVE WAYS TO "LIFT" OLD HOMES:

Corral gate for a ranch look.

Outdoor room in breezeway.

Rails and trim between posts.

Oriental divider planter.

nails, then position the sections in the post notches the same way. Add crosspieces, set posts in concrete and remove bracing.

You can adapt this archway to brick posts by anchoring it to bolts imbedded in the mortar.

A wagon-wheel gate is appropriate for ranch homes. Wheels are usually available at antique, second-hand or junk dealers and discarded croquet balls will serve well as post balls.

The anchor gate is a natural for seashore residences and beach cottages. The corral-type gate is built in the same manner.

Porch improvements. Ornamental iron work can replace a wood post and trim. When making a similar conversion, be sure the porch overhang is amply supported before removing the old post. You can obtain such ornamental posts and trim from dealers listed in phone books under "Iron Work" and from some hardware dealers. They are usually custom-made to your specifications.

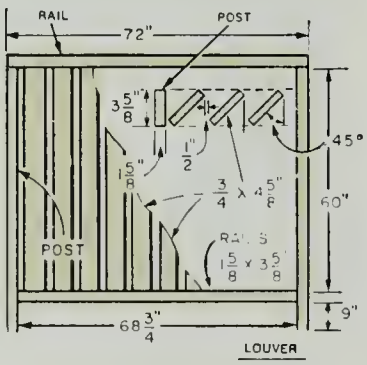
For a simple, inexpensive porch railing you can use 1⅝ x 2⅝-inch stock (2 x 3s). Or, using the same wood, you can install open-effect vertical dividers.

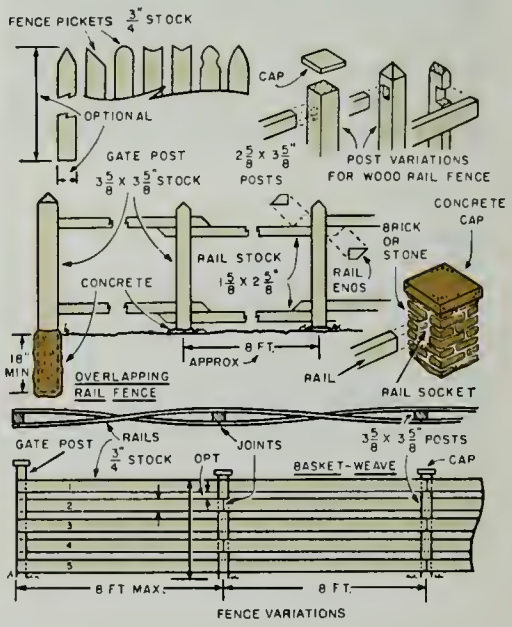
Breezeway walls. Enclosing the covered area between your home and garage adds, in effect, an outdoor room with whatever amount of privacy you wish. If you make it harmonize with the siding, your house will appear larger.

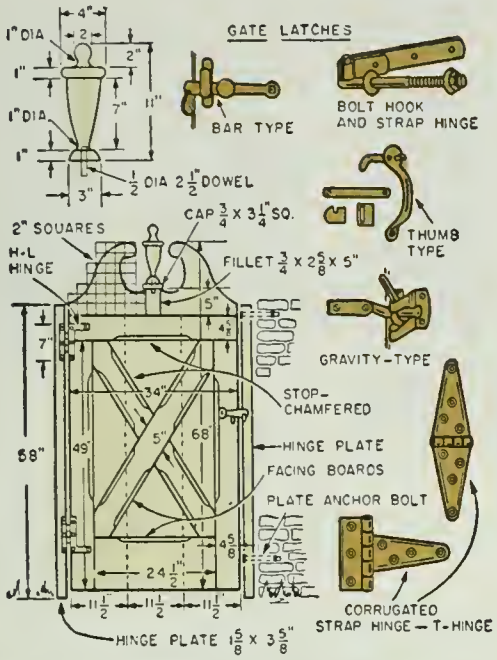
An easy way to improve your breezeway is to build a low-wall partition with center gate and lattice work. Two posts installed for the gate are the only heavy pieces needed. You can nail up wall plates to garage and house siding and run grooved cap rails between posts and plates for vertical board siding.

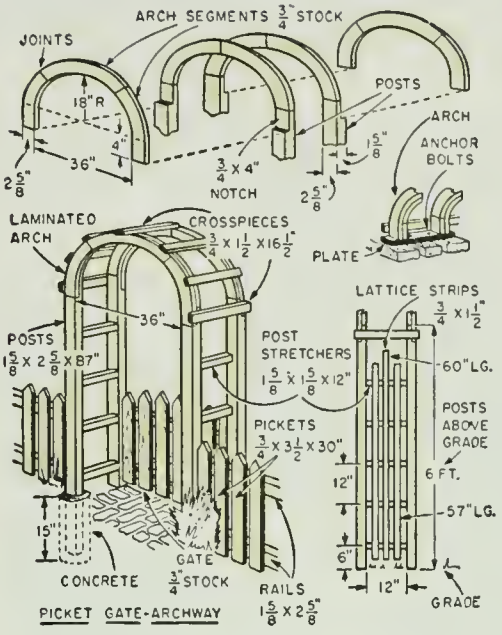
First toenail the lower grooved cap to wall plates and posts with ten penny nails.

▲ *Louvered fence panels provide front entry with effective shield from nearby walk.*









Then install boards in the grooves, fit top cap to the boards and toenail in place to posts and plates. Nail battens on both sides to conceal board joints and cover joints where boards meet posts and plates with quarter-round molding. Toenail ends of light lattice strips in place and reinforce them where they cross with #18 x ¾-inch wire nails.

Solid, high gate adds much to the privacy of a yard or garden area.

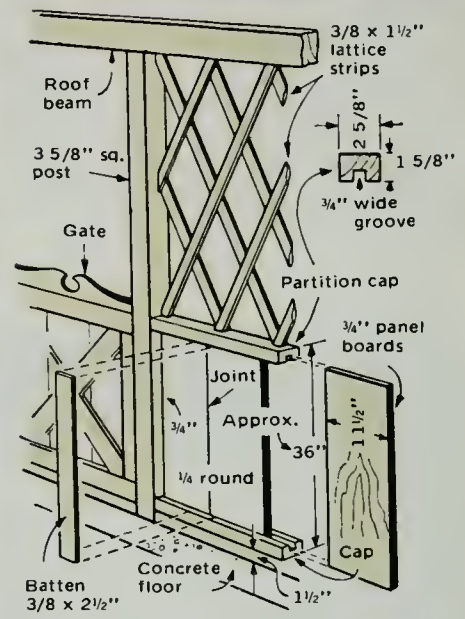
Ornamental iron work is easy to install on porches but, unless you are building a new work to fit standard, you may need to have parts made to order.

➤ *The addition of the ledge and cornice makes this window outstanding.*

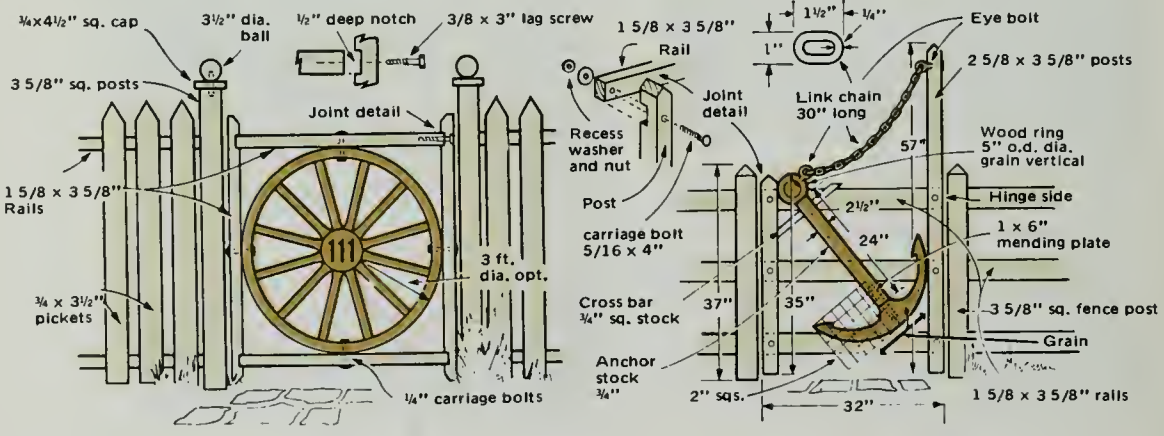
➤ *Simple breezeway improvement uses stained redwood board and batten siding to match that of house. Light lattice-work above is positioned so screens can be installed inside. It can be removed quickly for future installation of windows.*

The breezeway matches the clapboard siding of the house and uses 1⅝ x 3⅝-inch vertical and horizontal members (norminal 2 x 3s) to form shelf frames for small potted plants.

See also: CONCRETE BLOCKS; FENCES; FENCE-STORAGE SHED, LUMBER; WOODWORKING.



BREEZEWAY PARTITION



➤ *The well-planned one-story addition can add interest to an otherwise ordinary house.*

How to Add a Room to Your House

Do most of the work yourself and save on construction costs as well as increasing the value of your property

THERE COMES A TIME in the life of almost every small-home owner when his original castle seems to have shrunken to the squeezing point; when there no longer is sufficient room for his growing or increasing family. One solution to the problem is to make your house grow in proportion to the needs of your family by adding a bedroom or two and perhaps a bathroom or lavatory, or even by enlarging the kitchen, dining or living room.

If you have plenty of ground space, and can do all or most of the work yourself, you not only save money on the actual construction but you may also increase the value of your home.

Locating additional rooms. Practically every kind of floor-plan arrangement of a moderate price home can be expanded to include one or two additional bedrooms, some with an extra bathroom. A terrace bounded by extensions becomes a bedroom; a breezeway and attached garage can usually be changed into a bath and two bedrooms.

When planning additional bedrooms, remember to provide private access to the bathroom. Additional bedrooms can be connected to the bathroom with a hall made by taking 42 inches (36 inches for hall plus partition width) from an existing bedroom. This is the minimum space needed for comfortable use and allows for a 30-inch door.

Plan bedroom closet space 30 inches deep to allow for clothes hangers. Locate windows to permit cross-ventilation if possible, and to provide sufficient wall space for furniture. However, placement of furniture need not be considered when

locating casement windows as these are situated 40 inches above the floor.

Check your heating-equipment capacity. If it is not adequate for additional rooms, you will usually find it less expensive to purchase another smaller heater to use with the original heater rather than scrap the original heater and install a larger one.

When planning an additional bathroom, you can save on plumbing installation cost by locating the bathroom as near as possible to the kitchen or original bathroom. A window must be provided in the bathroom for ventilation.

How will the exterior look? While logical arrangement of rooms, privacy, accessibility and good ventilation are of primary importance when planning expansion, the outward relationship between an addition and the existing structure, particularly the roof, must also be given consideration.

For an addition, it is a good rule to stick to the same type and slope of roof as on your present house. A combination of gable and hip roof is not too attractive, and a shed-type room used with gable or hip often has the appearance of an afterthought. On a shed-roofed house however, only a shed-type roof will harmonize.

To avoid a continuous sharp joint line between original structure and addition, remove a part of the roof covering to permit lapping of shingles, and remove sections of the present siding, replacing with new and longer ones to obtain a staggered joint.

All of this added labor can be avoided however, if the roof of the addition is made lower than the existing roof and if the walls are offset from the existing structure. The difference in roof and wall line can be as little as three inches, which won't materially affect ceiling height or room size. This method requires no alteration of the existing roof, only the removal of siding material within the confines of the addition.

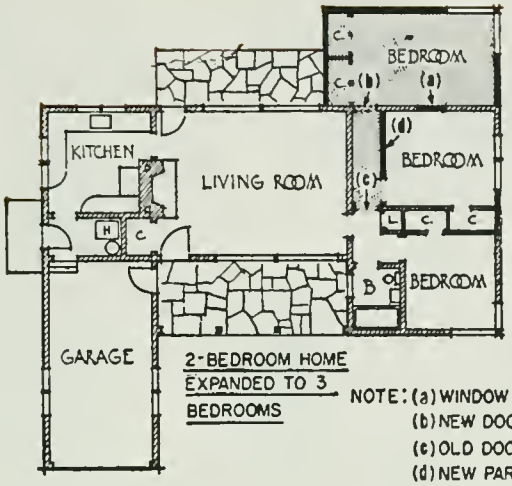
Drawing up plans. The first step is to plan your room addition on paper. This method permits you to see all of the various possibilities. If you do not have a set of architect's plans of your home and cannot get them, measure the rooms and outside of your house. Make a scaled drawing of the floor plan and outside end and side views of your house on graph paper. Use a scale of ¼-inch equals 1 foot.

When measuring the exterior of your home, also measure the roof slope or pitch so that the addition will have the same pitch. An easy way to determine the pitch of a gable roof is to drive a nail at the point of each eave, stretch a carpenter's chalk line tightly between these points and mark with a pencil along the approximate center of the span (width of house). Then, using a carpenter's or mason's level to insure a plumb vertical, measure the distance from the mark to the peak to obtain the peak height or total "rise." The horizontal measurement from eave to center of span is the "run." Translate rise footage to inches and divide by the run footage. For example: if a total rise equals 11 feet, 3 inches, or 135 inches, and run is 15 feet, the rise per foot run is 9 inches. This is termed 9-12 in the roof-pitch ratio system.

The width of the floor and ceiling joists will have to be known when making the scaled drawings.

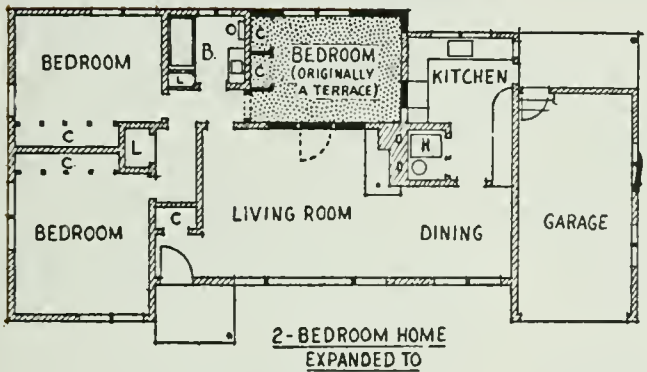
Figuring quantities and costs of building materials. Your best bet is to take your scaled drawings to your local lumber dealer. He will be glad to figure the amount of material needed and give you a cost estimate. You will, however, have to give him information as to the type of siding and roofing on the existing building and the kind of interior walls (plaster board, plywood, etc.) you intend to have in the addition. He will also suggest available sizes of complete window and door ensembles.

The foundation. Actual construction of your new addition starts with laying out

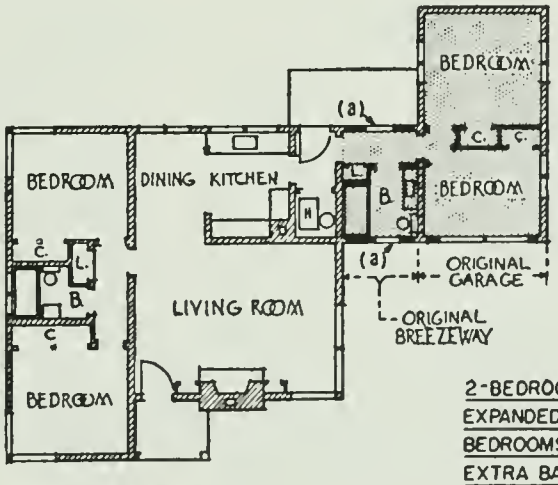


2-BEDROOM HOME EXPANDED TO 3 BEDROOMS

NOTE: (a) WINDOW REMOVED
(b) NEW DOOR IN OLD WALL
(c) OLD DOOR REMOVED
(d) NEW PARTITION

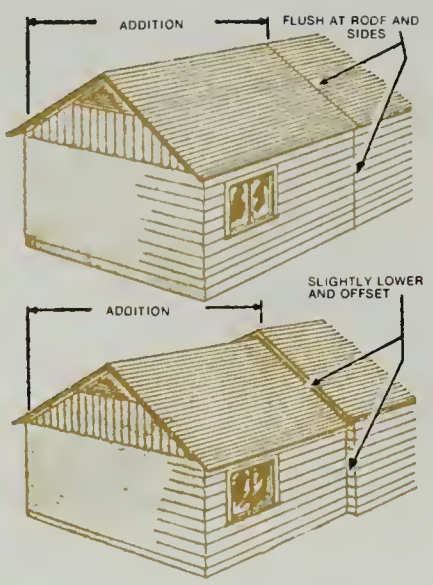


2-BEDROOM HOME EXPANDED TO 3 BEDROOMS



2-BEDROOM HOME EXPANDED TO 4 BEDROOMS AND EXTRA BATH

NOTE: (a) NEW WINDOWS



and excavating for the foundation. Having one true line (the existing bulding) to work from, lay out the boundaries of the foundation with chalk lines fastened to batten boards. Set the chalk lines at 90° to the existing foundation and level the lines.

After your foundation lines have been located, dig a trench wide enough to install the footing forms. Taper the trench to prevent cave-ins, and dig it deep enough to set the bottom of the footing 6 inches below the frost line in your area. Level the bottom of the trench both ways and establish the corners and footing width by using a plumb bob at the intersections of the lines. Drive stakes and nail up boards which will hold in concrete, making sure the tops of the boards are level across and lengthwise. Do the same for a pier.

Since the footing must be poured in one operation, you will probably purchase ready-mix concrete. The amount of concrete needed can be determined by measuring in feet and using this formula:

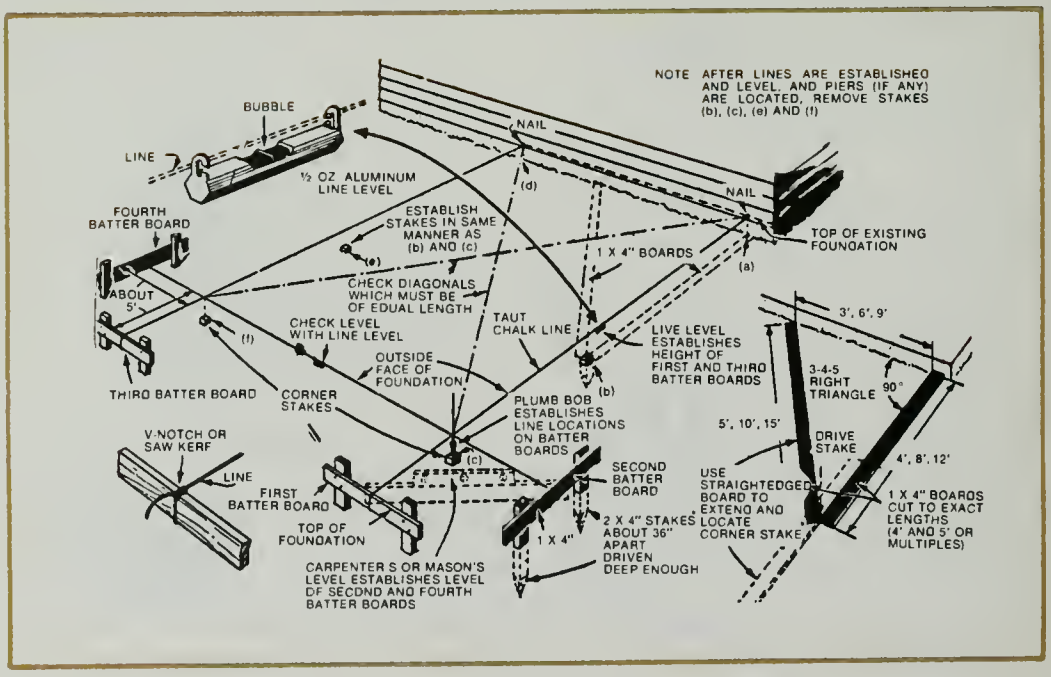
$$\frac{\text{width} \times \text{length} \times \text{depth}}{27} = \text{cubic yards}$$

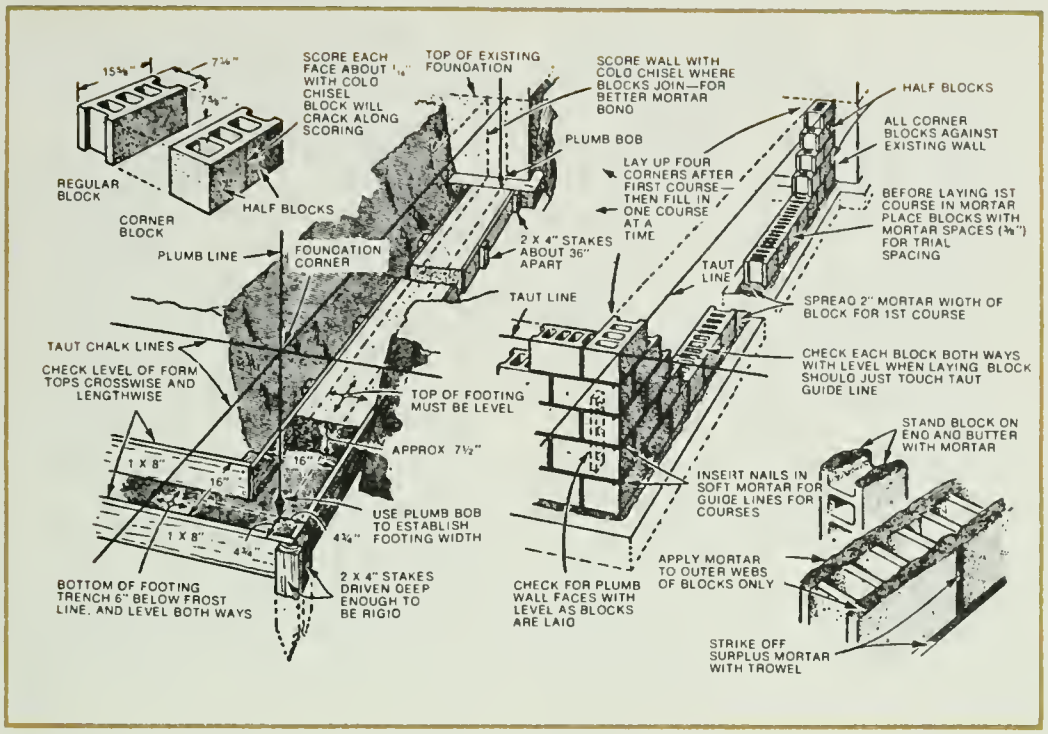
For example, a footing 8 inches x 16 inches x 20 feet is computed as follows:

$\frac{2}{3} \times 1\frac{1}{3} \times 20 = 53$ cubic feet

$53 \div 27 =$ approximately 2 cubic yards

As the concrete is being poured, spread


NOTE AFTER LINES ARE ESTABLISHED AND LEVEL, AND PIERS (IF ANY) ARE LOCATED, REMOVE STAKES (b), (c), (e) AND (f)
BUBBLE
LINE
½ OZ ALUMINUM LINE LEVEL
NAIL
(d)
NAIL
FOURTH BATTER BOARD
ESTABLISH STAKES IN SAME MANNER AS (b) AND (c)
(e)
1 X 4" BOARDS
TOP OF EXISTING FOUNDATION
(a)
ABOUT 5'
CHECK DIAGONALS WHICH MUST BE OF EDUAL LENGTH
3', 6', 9'
(f)
CHECK LEVEL WITH LINE LEVEL
TAUT CHALK LINE
LIVE LEVEL ESTABLISHES HEIGHT OF FIRST AND THIRD BATTER BOARDS
OUTSIDE FACE OF FOUNDATION
3-4-5 RIGHT TRIANGLE
90°
THIRD BATTER BOARD
CORNER STAKES
(b)
PLUMB BOB ESTABLISHES LINE LOCATIONS ON BATTER BOARDS
5', 10', 15'
DRIVE STAKE
V-NOTCH OR SAW KERF
(c)
4', 8', 12'
LINE
SECOND BATTER BOARD
USE STRAIGHTEDGED BOARD TO EXTEND AND LOCATE CORNER STAKE
FIRST BATTER BOARD
1 X 4" BOARDS CUT TO EXACT LENGTHS (4' AND 5' OR MULTIPLES)
TOP OF FOUNDATION
1 X 4"
2 X 4" STAKES ABOUT 36" APART DRIVEN DEEP ENOUGH
CARPENTER'S OR MASON'S LEVEL ESTABLISHES LEVEL OF SECOND AND FOURTH BATTER BOARDS


SCORE EACH FACE ABOUT 1/4" WITH COLD CHISEL BLOCK WILL CRACK ALONG SCORING
TOP OF EXISTING FOUNDATION
SCORE WALL WITH COLD CHISEL WHERE BLOCKS JOIN—FOR BETTER MORTAR BOND
HALF BLOCKS
ALL CORNER BLOCKS AGAINST EXISTING WALL
PLUMB BOB
LAY UP FOUR CORNERS AFTER FIRST COURSE — THEN FILL IN ONE COURSE AT A TIME
BEFORE LAYING 1ST COURSE IN MORTAR PLACE BLOCKS WITH MORTAR SPACES (3/8") FOR TRIAL SPACING
REGULAR BLOCK
CORNER BLOCK
HALF BLOCKS
PLUMB LINE
FOUNDATION CORNER
2 X 4" STAKES ABOUT 36" APART
TAUT LINE
TAUT LINE
SPREAD 2" MORTAR WIDTH OF BLOCK FOR 1ST COURSE
TAUT CHALK LINES
CHECK LEVEL OF FORM TOPS CROSSWISE AND LENGTHWISE
CHECK EACH BLOCK BOTH WAYS WITH LEVEL WHEN LAYING. BLOCK SHOULD JUST TOUCH TAUT GUIDE LINE
TOP OF FOOTING MUST BE LEVEL
STAND BLOCK ON END AND BUTTER WITH MORTAR
APPROX 7½"
1 X 8"
16"
16"
INSERT NAILS IN SOFT MORTAR FOR GUIDE LINES FOR COURSES
USE PLUMB BOB TO ESTABLISH FOOTING WIDTH
1 X 8"
APPLY MORTAR TO OUTER WEBS OF BLOCKS ONLY
BOTTOM OF FOOTING TRENCH 6" BELOW FROST LINE, AND LEVEL BOTH WAYS
2 X 4" STAKES DRIVEN DEEP ENOUGH TO BE RIGID
CHECK FOR PLUMB WALL FACES WITH LEVEL AS BLOCKS ARE LAID
STRIKE OFF SURPLUS MORTAR WITH TROWEL

and tamp it down with a hoe to fill all spaces and to bring water to the top. After the final pouring, spreading and tamping, scrape off surplus concrete with a board bridging the tops of the forms. In hot weather the concrete will set too quickly for good strength so keep it damp by covering with wet burlap bags, or sprinkle it occasionally for a few days, after two or three hours of setting. Immediately after pouring, however, it should be protected from rain with a covering of tar paper.

Three types of concrete blocks will be needed for the foundation walls; regular and corner blocks, and half-blocks for joining at existing wall. If half-blocks are not available, a full block can be cut with little difficulty.

A strong mortar for the concrete blocks can be made from one part portland cement and two parts clean, sharp sand (by volume), with enough clean water to make a workable plastic mass. Concrete blocks absorb water quickly, so if they are not dampened before mortar is applied, mix the mortar a bit on the wet side, but stiff enough to support the weight of the block when tapped in place. If block cannot be tapped down in alignment with a trowel, mortar is too stiff.

To mix the mortar, use a piece of tar paper with turned-up edges, or any flat container which is large enough to permit manipulation of a hoe (about 24 x 24-inch). Mix dry ingredients thoroughly, make a depression in the center and add a little water; mix and add more water until the right consistency is obtained. This will come about suddenly, so go easy on the water. Do not try thickening a soupy mixture by adding dry ingredients. Mix only enough mortar for 15 minutes use.

Spread a 2-inch bed of mortar, slightly wider than a block, on the footing as you lay the first course. Use a taut line as a guide nailed to the footing form and

weighted at the juncture of existing and new footing. A plumb bob locates line. Check often with a mason's level across and lengthwise.

Install vents in the top course on opposite walls to protect joists, etc. from decay. Make a homemade vent or use a commercial type.

If you are planning a bathroom as part of your extension, 24 inches of crawl space and access opening under the joists is a must for installing and servicing lines. Also, hot air heating ducts are more easily installed under joists. You can install a window using either jamb blocks or regular blocks. If the finished grade level is only 8 to 12 inches from the bottom of the finished siding, an areaway of masonry must be provided around the window. If your plot is more or less flat, make a trap door in the floor of a hallway or closet.

If the span of your addition requires a pier, make it of courses of two concrete blocks lapped. The footing for these piers can be poured when the foundation footings are poured.

Having laid the foundation, imbed sill bolts. Stuff newspaper in the holes at the bottom of the second block from the top to hold the bolt and mortar while setting. Pour a bit of mortar to form a bed, then place bolt and fill hole.

Although sills can be bolted to the top of foundation walls without a mortar bed, such a bed results in a tight, draft-free job. The outside face of the sill should be ¾-inch from the face of the foundation if you plan on using ¾-inch sheathing material; ½-inch for plywood sheathing. Plywood sheathing is better for a number of reasons. It does not require corner bracing and is stronger than horizontally laid ¾-inch sheathing which should be braced; it costs practically the same and is more quickly put up.

A single sill is adequate for a one-story addition, but if your existing sill is doubled, double the new one so that the floor will be even with floor in existing building. If your extension is longer or wider than 24 feet, you will have to splice the sill.

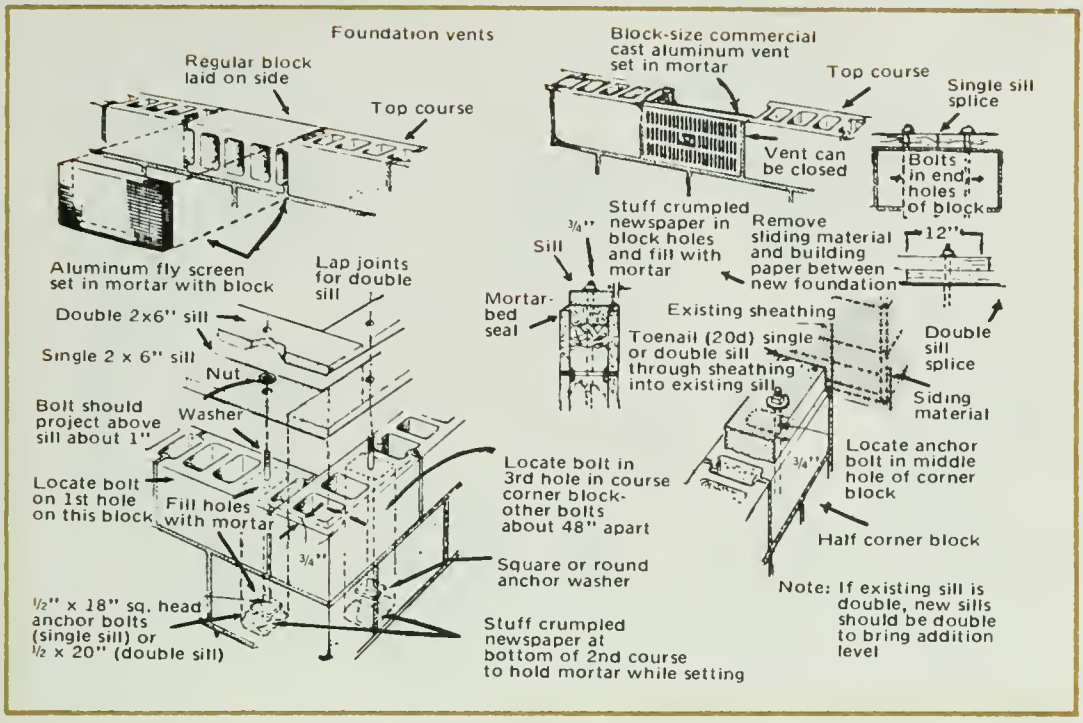
Joists and headers. Headers are used in Western platform framing which produces draft-free joist framing and allows the rough or sub-flooring to be laid without cut-outs for studs. It also produces a more rigid type of framing and allows work to progress above the sill without difficulty, due to the rough flooring. Use 20d nails to nail headers to joists, and ledger to sill; 10d nails to toenail joists and headers to sill.

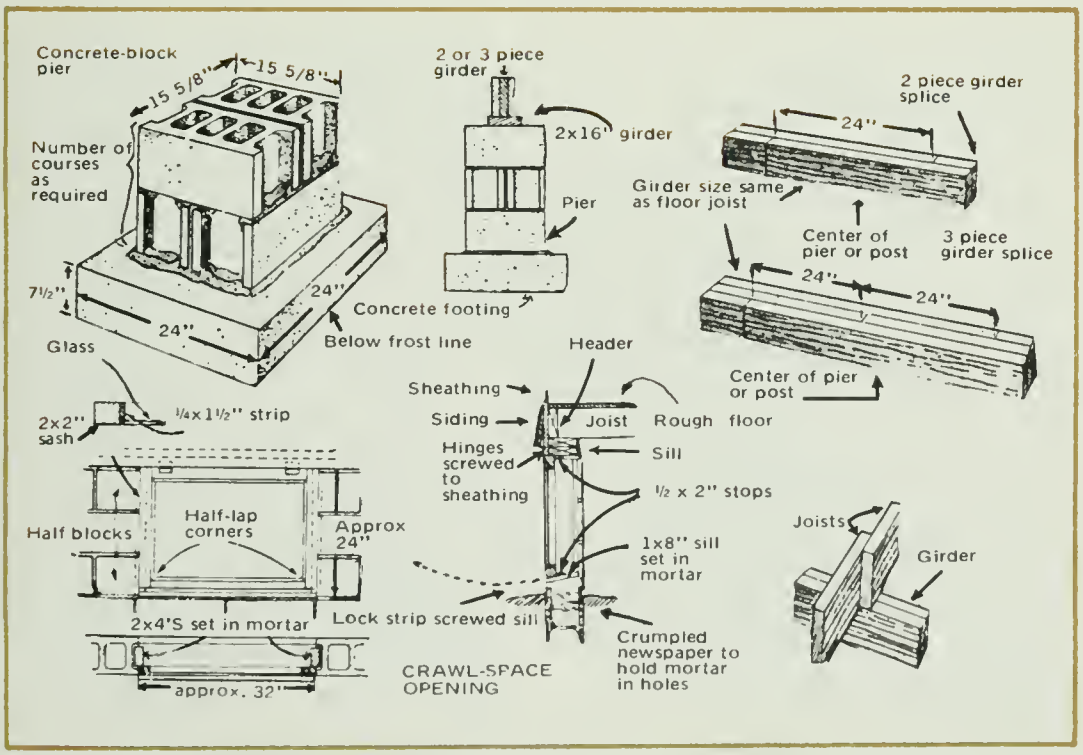
Loads bearing on joists tend to bow out the joist unless bracing is introduced. For every 6 to 8 feet of unsupported span, cross-bridging is customary. First nail the bridging to tops of joists, then, after rough floor is laid nail bridging to joists bottoms.

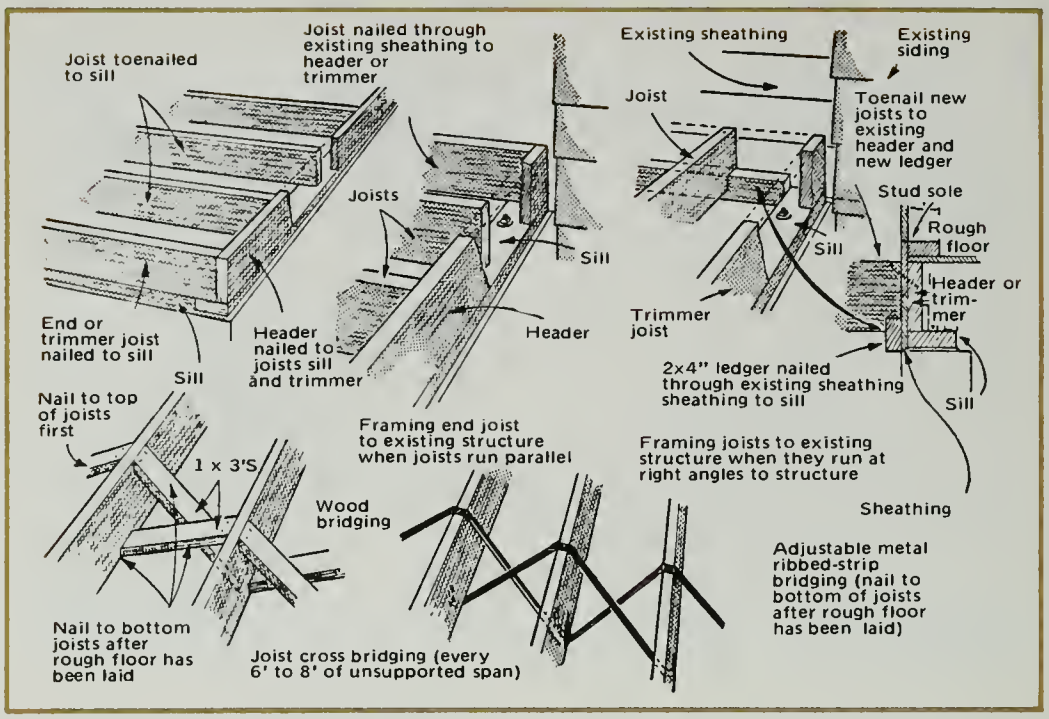
Girders should be supported by piers, 20d, unless large enough to support the loads imposed on them. They are usually doubled or tripled, and well spiked together with 20d nails from both faces. Girders requiring splicing should be spliced and, if supported by piers, placed on a cap. Joists framed directly on top of girders are the soundest type of construction.

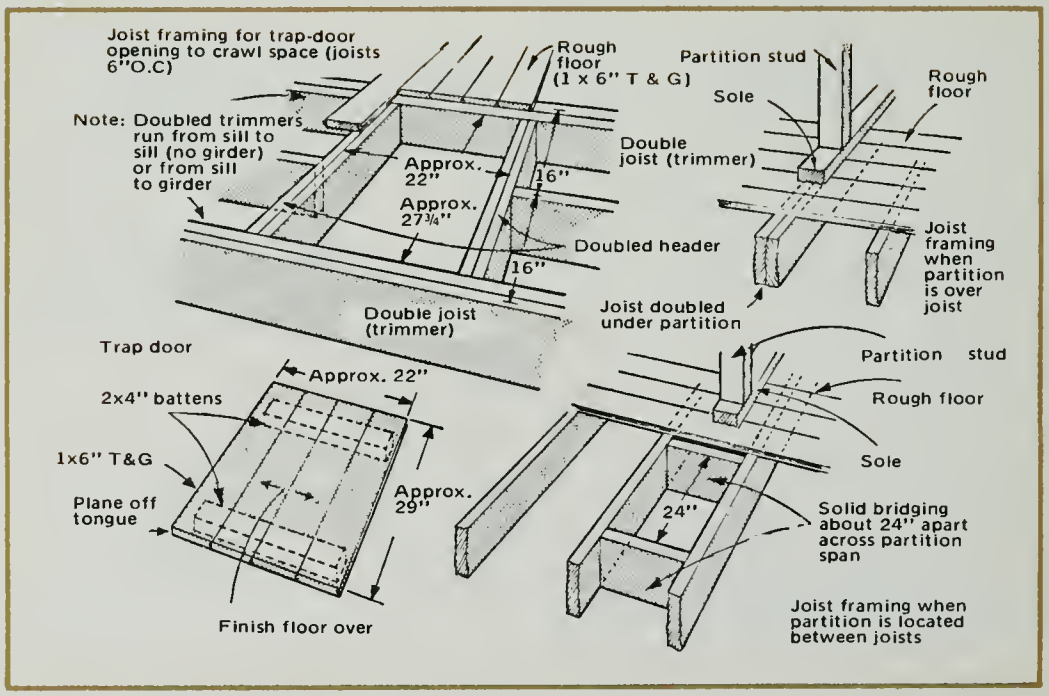
A partition to be run parallel to and over a joist should be supported by a doubled joist. This doubled joist can be spiked together or separated about 2½-inch with solid bridging between. Solid bridging is needed to distribute the load equally between joists. The latter method is better if BX electric cable is run under the joists and up into the partition. A space of about 8 inches should be used if waste and water pipes or heating ducts are to be run in the partition. Frame any opening wider than one spacing of joists. Nail single headers in place first. Then nail second or double headers to the first ones. Finally set up the double joists and spike them together.

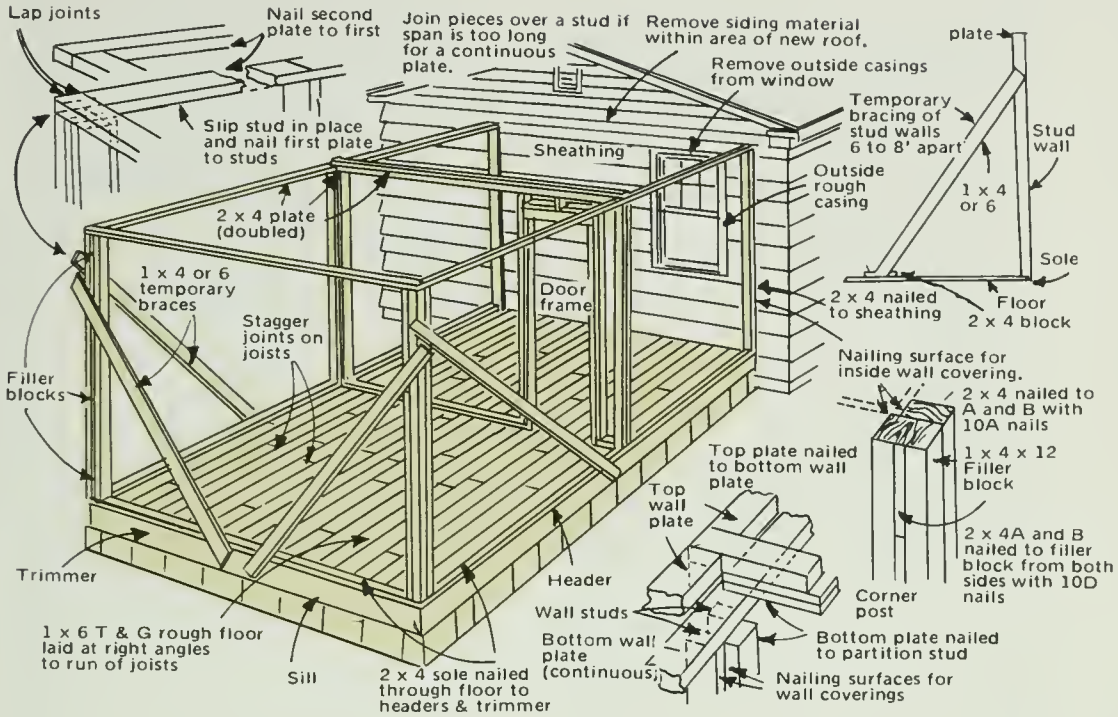
The question of insulating the floor fol-


Foundation vents
Regular block laid on side
Top course
Aluminum fly screen set in mortar with block
Lap joints for double sill
Double 2x6" sill
Single 2 x 6" sill
Nut
Washer
Bolt should project above sill about 1"
Locate bolt on 1st hole on this block
Fill holes with mortar
3/4"
1/2" x 18" sq. head anchor bolts (single sill) or 1/2 x 20" (double sill)
Locate bolt in 3rd hole in course corner block- other bolts about 48" apart
Square or round anchor washer
Stuff crumpled newspaper at bottom of 2nd course to hold mortar while setting
Block-size commercial cast aluminum vent set in mortar
Top course
Single sill splice
Vent can be closed
Bolts in end holes of block
Stuff crumpled newspaper in block holes and fill with mortar
3/4"
Sill
Mortar-bed seal
Remove sliding material and building paper between new foundation
12"
Existing sheathing
Toenail (20d) single or double sill through sheathing into existing sill
Double sill splice
Siding material
Locate anchor bolt in middle hole of corner block
3/4"
Half corner block
Note: If existing sill is double, new sills should be double to bring addition level


Concrete-block pier
15 5/8"
15 5/8"
Number of courses as required
7 1/2"
24"
24"
Glass
Concrete footing
Below frost line
2 or 3 piece girder
2x16" girder
Pier
2 piece girder splice
24"
Girder size same as floor joist
Center of pier or post
3 piece girder splice
24"
24"
Center of pier or post
2x2" sash
1/4x1 1/2" strip
Half blocks
Half-lap corners
Approx 24"
2x4'S set in mortar
approx. 32"
CRAWL-SPACE OPENING
Sheathing
Siding
Header
Joist
Rough floor
Hinges screwed to sheathing
Sill
1/2 x 2" stops
1x8" sill set in mortar
Lock strip screwed sill
Crumpled newspaper to hold mortar in holes
Joists
Girder


Joist toenailed to sill
Joist nailed through existing sheathing to header or trimmer
Joists
Sill
Header
End or trimmer joist nailed to sill
Header nailed to joists sill and trimmer
Sill
Existing sheathing
Existing siding
Joist
Toenail new joists to existing header and new ledger
Stud sole
Rough floor
Sill
Header or trimmer
Trimmer joist
2x4" ledger nailed through existing sheathing sheathing to sill
Sill
Sheathing
Nail to top of joists first
1 x 3'S
Framing end joist to existing structure when joists run parallel
Framing joists to existing structure when they run at right angles to structure
Wood bridging
Adjustable metal ribbed-strip bridging (nail to bottom of joists after rough floor has been laid)
Nail to bottom joists after rough floor has been laid
Joist cross bridging (every 6' to 8' of unsupported span)


Joist framing for trap-door opening to crawl space (joists 6"O.C)
Rough floor (1 x 6" T & G)
Partition stud
Sole
Rough floor
Note: Doubled trimmers run from sill to sill (no girder) or from sill to girder
Approx. 22"
16"
Approx. 27¾"
Doubled header
16"
Double joist (trimmer)
Double joist (trimmer)
Joist framing when partition is over joist
Joist doubled under partition
Trap door
Approx. 22"
Partition stud
Rough floor
2x4" battens
1x6" T&G
Sole
Plane off tongue
Approx. 29"
24"
Solid bridging about 24" apart across partition span
Finish floor over
Joist framing when partition is located between joists


Lap joints
Nail second plate to first
Join pieces over a stud if span is too long for a continuous plate.
Remove siding material within area of new roof.
Remove outside casings from window
Slip stud in place and nail first plate to studs
Sheathing
Temporary bracing of stud walls 6 to 8' apart
Outside rough casing
2 x 4 plate (doubled)
1 x 4 or 6 temporary braces
Stagger joints on joists
Door frame
Filler blocks
Trimmer
1 x 6 T & G rough floor laid at right angles to run of joists
Sill
2 x 4 sole nailed through floor to headers & trimmer
Header
plate
Stud wall
1 x 4 or 6
Sole
2 x 4 nailed to sheathing
Floor 2 x 4 block
Nailing surface for inside wall covering.
2 x 4 nailed to A and B with 10A nails
1 x 4 x 12 Filler block
2 x 4A and B nailed to filler block from both sides with 10D nails
Corner post
Top plate nailed to bottom wall plate
Top wall plate
Wall studs
Bottom wall plate (continuous)
Bottom plate nailed to partition stud
Nailing surfaces for wall coverings
Wall board
Stud framing where partitions cross

lows. If you've used the closing-type vent and cemented your sill to the foundation, a chilly floor shouldn't result. Otherwise, you might find the floor on the cool side which, of course, floor coverings will minimize. It is also a question of what your budget allows. Aluminum-foil insulation is perhaps the most practical under a floor near the ground and, if no crawl space exists, it can be stapled or nailed to the joist faces before the subfloor is laid.

Sub or rough flooring is usually laid diagonally, primarily for its bracing qualities and because a finish floor can be laid over it in either direction. However, for economy and ease of laying, the floor may be laid at right angles to and across the joists. This means, of course, that the finish floor must be laid at right angles to rough floor.

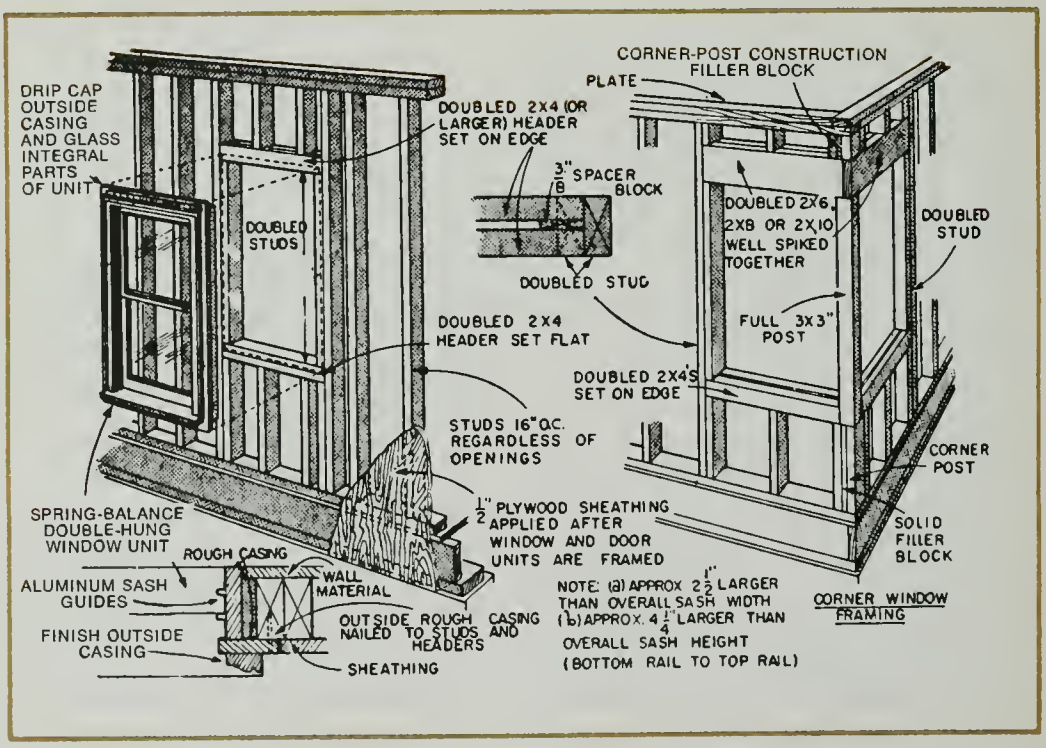
With the rough floor finished, nail 2x4-inch soles through the floor to the headers and end joists with 16d nails staggered along the edges. Then make up two corner posts. Three 2x4s are used on corner posts to provide nailing surfaces for the inside wall covering, whatever material it may be. You will need help to plumb them while nailing on the temporary braces. Plumbing is done with a carpenter's or mason's level. Toenail the posts to the sole with two 20d nails on each face, then nail a brace to a header and end joist, plumb one side of the post, then the other. A 2x4 nailed to the existing sheathing supports the plates at the house end. If possible, nail these 2x4s through the sheathing into an existing stud.

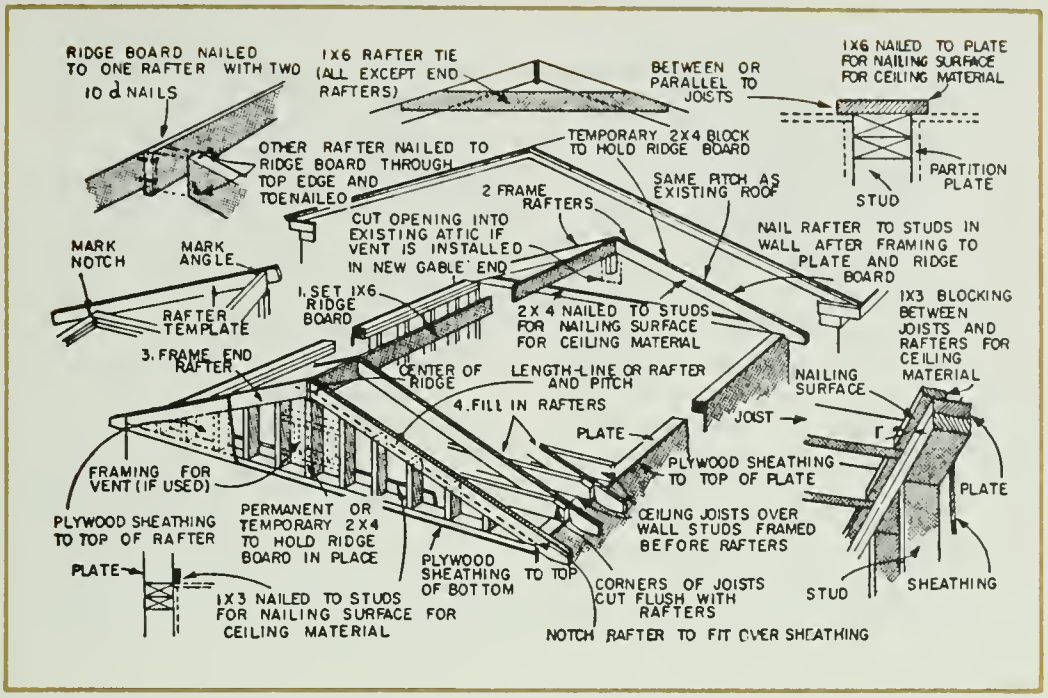
The plate comes next and is framed. The bottom member of the plate should be continuous, otherwise, join two members

over a stud. Other studs on 16-inch centers are cut to exact length and singly slipped under the plate, plumbed and nailed. Extra studs for openings are framed later. The top plate is then nailed to the first and, where partitions join the outside wall, the top member is framed. Partition plates are framed in like manner. If the bottom member must be spliced, be sure to stagger any joint in top member. Also, inside corner studs for partitions are made up for partitions that are continuous both ways. All partition studs rest on soles. Be sure to temporarily brace outside walls and partitions until sheathing and roof boards are in place. If a bathroom is being included, the partition in which soil and vent pipes are to be placed must be made up of 2x6s to provide room for pipes.

For correct framing of the door, use double studs and double headers on edge with a short stud (cripple) supporting the plate. To figure the rough opening for a doorway, add about 1½-inch to the overall jamb or frame width of the door, and about one inch to the overall height. Door frames vary in thickness depending on whether the stop is dadoed in, nailed to the jamb face, or machined from solid jamb stock, so check with your lumber yard. You can make your own door frames from 1x6-inch clear white pine, ripping it to the correct width which should be the width of the stud plus two thicknesses of wall covering materials.

In stud framing of windows, double-hung window units today are mostly of the spring-balance type. These units make a tighter fit than the old weight box type and come either knocked down for you to assemble, or complete. Inquire from your lumber dealer as to the required rough-opening size. The better units are furnished with spring-metal flashing. Modern-type casement-window units are also available, similar in construction. When framing studs


CORNER-POST CONSTRUCTION
FILLER BLOCK
PLATE
DRIP CAP OUTSIDE CASING AND GLASS INTEGRAL PARTS OF UNIT
DOUBLED 2X4 (OR LARGER) HEADER SET ON EDGE
3/8" SPACER BLOCK
DOUBLED STUDS
DOUBLED 2X6, 2X8 OR 2X10 WELL SPIKED TOGETHER
DOUBLED STUD
DOUBLED STUD
DOUBLED 2X4 HEADER SET FLAT
FULL 3X3" POST
DOUBLED 2X4'S SET ON EDGE
STUDS 16" O.C. REGARDLESS OF OPENINGS
CORNER POST
SPRING-BALANCE DOUBLE-HUNG WINDOW UNIT
1/2" PLYWOOD SHEATHING APPLIED AFTER WINDOW AND DOOR UNITS ARE FRAMED
SOLID FILLER BLOCK
ROUGH CASING
ALUMINUM SASH GUIDES
WALL MATERIAL
FINISH OUTSIDE CASING
OUTSIDE ROUGH CASING NAILED TO STUDS AND HEADERS
SHEATHING
NOTE: (a) APPROX 2 1/2" LARGER THAN OVERALL SASH WIDTH
(b) APPROX. 4 1/4" LARGER THAN OVERALL SASH HEIGHT (BOTTOM RAIL TO TOP RAIL)
CORNER WINDOW FRAMING


RIDGE BOARD NAILED TO ONE RAFTER WITH TWO 10 d NAILS
1X6 RAFTER TIE (ALL EXCEPT END RAFTERS)
BETWEEN OR PARALLEL TO JOISTS
1X6 NAILED TO PLATE FOR NAILING SURFACE FOR CEILING MATERIAL
PARTITION PLATE
STUD
OTHER RAFTER NAILED TO RIDGE BOARD THROUGH TOP EDGE AND TOENAILED
TEMPORARY 2X4 BLOCK TO HOLD RIDGE BOARD
SAME PITCH AS EXISTING ROOF
2 FRAME RAFTERS
CUT OPENING INTO EXISTING ATTIC IF VENT IS INSTALLED IN NEW GABLE END
NAIL RAFTER TO STUDS IN WALL AFTER FRAMING TO PLATE AND RIDGE BOARD
MARK NOTCH
MARK ANGLE
RAFTER TEMPLATE
1. SET 1X6 RIDGE BOARD
2X4 NAILED TO STUDS FOR NAILING SURFACE FOR CEILING MATERIAL
1X3 BLOCKING BETWEEN JOISTS AND RAFTERS FOR CEILING MATERIAL
3. FRAME END RAFTER
CENTER OF RIDGE
LENGTH-LINE OR RAFTER AND PITCH
NAILING SURFACE
4. FILL IN RAFTERS
JOIST
PLATE
PLYWOOD SHEATHING TO TOP OF PLATE
FRAMING FOR VENT (IF USED)
PLATE
PLYWOOD SHEATHING TO TOP OF RAFTER
PERMANENT OR TEMPORARY 2X4 TO HOLD RIDGE BOARD IN PLACE
CEILING JOISTS OVER WALL STUDS FRAMED BEFORE RAFTERS
PLYWOOD SHEATHING TO TOP OF BOTTOM
CORNERS OF JOISTS CUT FLUSH WITH RAFTERS
STUD
SHEATHING
PLATE
1X3 NAILED TO STUDS FOR NAILING SURFACE FOR CEILING MATERIAL
NOTCH RAFTER TO FIT OVER SHEATHING

for walls, keep them to equal centers, disregarding any openings which, if they're located off center, require doubled studs in addition to the regular studs. Then, when interior wall boards are applied, your nailing surfaces will always be spaced equally. This also applies to partition openings.

For openings wider than 4 feet, use larger overhead doubled headers than 2x4s. In the past, the 2x4s were trussed, simply or intricately, depending on the span, but present-day methods lean toward larger headers which are easier and quicker to install.

Sheathing. Your next step, after window frames have been installed, is to sheath the outside walls. You have a choice of three basic sheathing materials: wood sheathing, fiberboard or plywood. Solid wood sheathing applied diagonally is no stronger than ⅜ or ½-inch sheathing plywood applied lengthwise or vertically. Neither material requires corner bracing. However, with the cost of lumber what it is today, very few structures are being sheathed diagonally because of the considerable waste and time consumed applying it. Wood sheathing today is usually put on horizontally, and in the better constructed homes, corner bracing of 1x4s is let in flush with plate, studs, headers and sill. This means notching out these members at a 45° angle.

Asphalt-saturated fiberboard, ½-inch or $^{25}/_{32}$-inch thick has better insulating properties than solid wood or plywood, but compares with horizontal wood sheathing for rigidity and, therefore, should also be braced. This material has a poor nailing surface when wood or asbestos shingles are used for siding. Special self-clamping nails must be used, or wood battens nailed over the fiberboard to the studs to furnish nailing surfaces for shingles. Plywood, however, holds nails as well as solid ¾-inch sheathing. To nail on ½-inch plywood, use 8d nails spaced about 6 inches at the edges and about 10 inches on intermediate studs. Stagger vertical joints of plywood,

unless the sheets run from sill to plate. Structural members, including sill and plate, must be tied together with plywood for a rigid job. Do not just patch a section here and there and expect strength and rigidity. This does not mean that strips to cover a stud or header around openings are not permissible. Do, however, cover as large an area as possible with each panel.

After sheathing the outside, you will notice an amazing gain in rigidity of all vertical members. This will be even more noticeable as you frame the ceiling joists over the stud locations. These are toenailed to the plate with 10d nails from each face. It is advisable to frame a trap door opening in the ceiling joists to gain access to the attic space, a must if you plan to insulate the ceiling joists. This opening is framed exactly like the floor opening—in a hall or closet—but the door can be of much lighter construction than that for the floor.

Rafters and roof. To frame a rafter correctly, the center of the ridge board is taken as the total rise height from top of plate. The run is half the span between outside edges of plates. Length of the rafter is a line between edge of plate and center of ridge board. If you are using the table on a rafter and framing square, the dimensions noted on it are based on the above points of measurement. Detailed instruction in the use of the many tables on a rafter and framing square are furnished in booklet form with each square. The jack-rafter tables are invaluable when cutting the multiple angles of hip-roof framing.

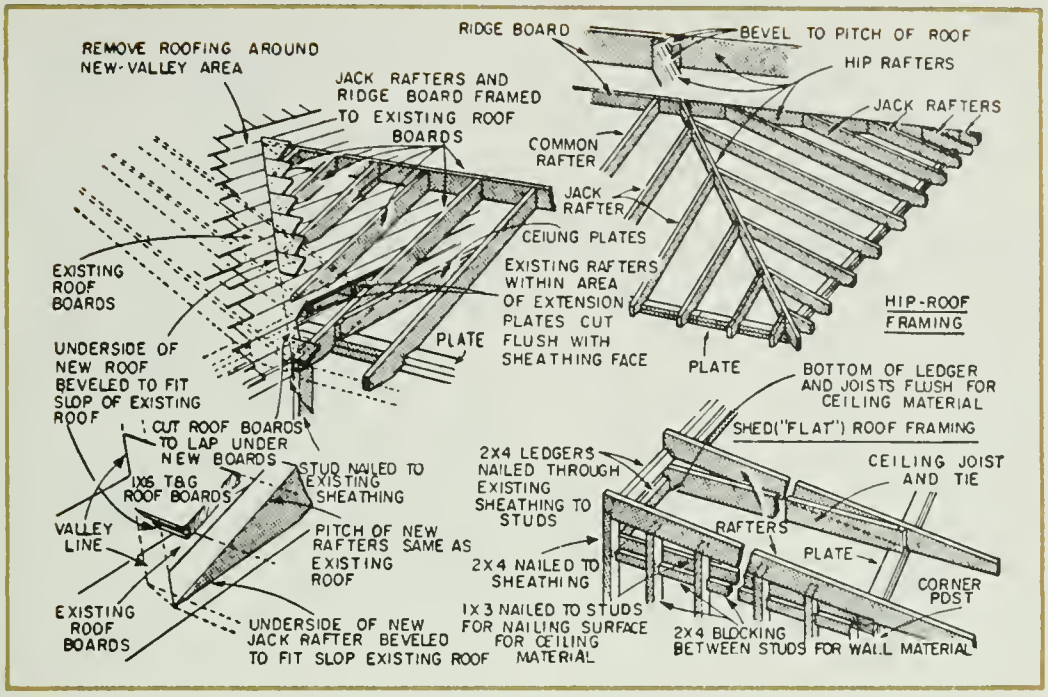
SPAN ALLOWANCE

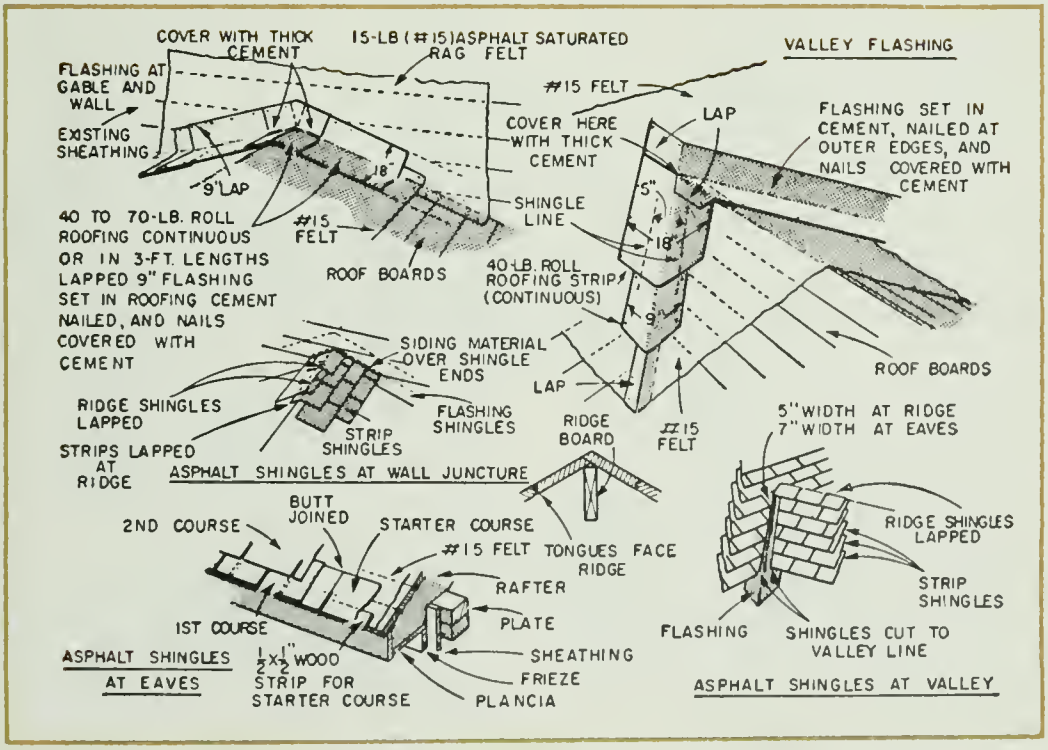
	12 IN. O.C.	16 IN. O.C.
Floor Joists—40 lbs. Live Load		
2 x 6″ (Nominal)	10′-8″	9′-8″
2 x 8″	14′-1″	12′-11″
2 x 10″	17′-9″	16′-3″
2 x 12″	21′-4″	19′-7″
Ceiling Joists—No Live Load		
2 x 4″	11′-0″	10′-1″
2 x 6″	16′-7″	15′-4″
2 x 8″	21′-7″	20′-1″
2 x 10″	26′-9″	25′-0″
Roof Rafters—30 lbs. Live Load		
2 x 4″	7′-6″	6′-10″
2 x 6″	11′-6″	10′-6″
2 x 8″	15′-3″	13′-11″
2 x 10″	19′-2″	17′-16″
2 x 12″	23′-0″	21′-1″

NOTE: Based on the use of Douglas fir or short-leaf yellow pine.

First set up the ridge board, temporarily nailing the board to the block and gable stud. Also brace this stud temporarily with a pair of diagonals nailed to the plate. A sure-fire method of establishing the correct angle of the rafter end at the ridge board and the angles of the notch at the plate is to proceed with a blank rafter. Measure the distance from the centerline of the ridge board to the top of the rafter, and transfer this measurement to the corner of the plate to top of rafter. Nail rafter lightly at both points. Mark the notch and angle. Measure out from sheathing the extension you plan for the rafter if it is to be a box or open cornice, marking the top edge. With a square against the side, scribe a line for the flat underside of the rafter. Remove the rafter and saw out the notch and various angles. After the flat underside of the rafter has been cut out, use a try square on the face and scribe a line from the marked top edge. Cut along this line and you have a 90° angle rafter end. If your ridge board is in the exact center of your span and parallel to both sides, you can use the rafter just cut as a template for the rest. Toenail rafter to plate and nail to joists, using 10d nails.

Cut gable-end studs and frame for a vent (if used). If the attic space is to be insulated, vents are always necessary. The vent for the exposed gable end can be pur-


RIDGE BOARD
BEVEL TO PITCH OF ROOF
HIP RAFTERS
JACK RAFTERS
REMOVE ROOFING AROUND NEW-VALLEY AREA
JACK RAFTERS AND RIDGE BOARD FRAMED TO EXISTING ROOF BOARDS
COMMON RAFTER
JACK RAFTER
CEILING PLATES
EXISTING ROOF BOARDS
EXISTING RAFTERS WITHIN AREA OF EXTENSION PLATES CUT FLUSH WITH SHEATHING FACE
HIP-ROOF FRAMING
PLATE
PLATE
UNDERSIDE OF NEW ROOF BEVELED TO FIT SLOP OF EXISTING ROOF
BOTTOM OF LEDGER AND JOISTS FLUSH FOR CEILING MATERIAL
SHED("FLAT") ROOF FRAMING
CUT ROOF BOARDS TO LAP UNDER NEW BOARDS
STUD NAILED TO EXISTING SHEATHING
2X4 LEDGERS NAILED THROUGH EXISTING SHEATHING TO STUDS
CEILING JOIST AND TIE
1X6 T&G ROOF BOARDS
VALLEY LINE
PITCH OF NEW RAFTERS SAME AS EXISTING ROOF
RAFTERS
PLATE
2X4 NAILED TO SHEATHING
CORNER POST
EXISTING ROOF BOARDS
UNDERSIDE OF NEW JACK RAFTER BEVELED TO FIT SLOP EXISTING ROOF
1X3 NAILED TO STUDS FOR NAILING SURFACE FOR CEILING MATERIAL
2X4 BLOCKING BETWEEN STUDS FOR WALL MATERIAL


COVER WITH THICK CEMENT
15-LB (#15) ASPHALT SATURATED RAG FELT
VALLEY FLASHING
FLASHING AT GABLE AND WALL
#15 FELT
LAP
FLASHING SET IN CEMENT, NAILED AT OUTER EDGES, AND NAILS COVERED WITH CEMENT
EXISTING SHEATHING
COVER HERE WITH THICK CEMENT
9" LAP
18"
5"
SHINGLE LINE
40 TO 70-LB. ROLL ROOFING CONTINUOUS OR IN 3-FT. LENGTHS LAPPED 9" FLASHING SET IN ROOFING CEMENT NAILED, AND NAILS COVERED WITH CEMENT
#15 FELT
ROOF BOARDS
40-LB. ROLL ROOFING STRIP (CONTINUOUS)
18"
9"
SIDING MATERIAL OVER SHINGLE ENDS
LAP
ROOF BOARDS
RIDGE SHINGLES LAPPED
FLASHING SHINGLES
RIDGE BOARD
#15 FELT
5" WIDTH AT RIDGE
7" WIDTH AT EAVES
STRIP SHINGLES
STRIPS LAPPED AT RIDGE
ASPHALT SHINGLES AT WALL JUNCTURE
BUTT JOINED
2ND COURSE
STARTER COURSE
#15 FELT TONGUES FACE RIDGE
RIDGE SHINGLES LAPPED
RAFTER
STRIP SHINGLES
1ST COURSE
PLATE
FLASHING
SHINGLES CUT TO VALLEY LINE
ASPHALT SHINGLES AT EAVES
1/2 X 1" WOOD STRIP FOR STARTER COURSE
SHEATHING
FRIEZE
PLANCIA
ASPHALT SHINGLES AT VALLEY

chased in aluminum, louvered with fly-screening attached. All that is needed at the existing end is an opening into the attic, with fly-screening tacked over for protection.

Rafter ties or collar beams are a must in sound roof construction, to prevent the rafter ends from pushing upward due to wind pressure. Nail these about 12 inches below the underside of the ridge board with four 10d nails at each end.

Wall and ceiling boards, of whatever type you use, require continuous nailing surfaces for all edges.

If you are planning to have a gabled extension joining the long side of an existing gable roof, hip roof or flat roof, follow the framing methods shown. Framing procedure, other than roof, is the same for all types. About 30 inches overhang is maximum for unsupported rafter ends, unless expensive and complicated cantilever construction is employed. Covering material, either T&7 solid boards or exterior-grade plywood, on the underside of the overhang is the usual practice. If the budget is close, the rafters can be left exposed.

Roof boards are the final rough framing job for all types of roofing material except wooden shingles. The boards are usually T&G sheathing not wider than 8 inches.

Start the roof boards at the eaves and, depending on what type cornice you are planning, extend the first board beyond the rafter end from 1¼ to 2 inches. Tongues of roof boards must face toward the ridge. Saw or plane the groove off the first board. Roof boards meet at the ridge board.

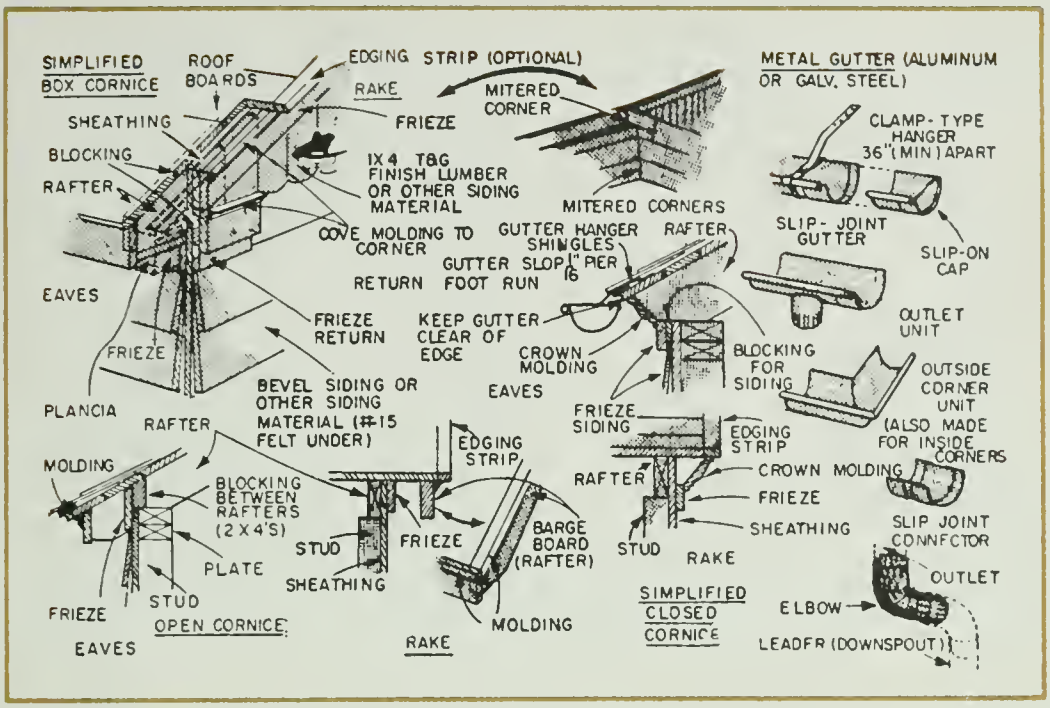
Before applying roofing material, cover the entire roof with 15-lb. asphalt-saturated rag felt (#15 rag felt) or cover a section as you apply roofing material. To prevent high winds from possibly ripping this covering, do not apply it until a day or so before you're ready with the roofing material. (The same holds true with respect to the felt over the sheathing applied prior to putting up the siding material.) The felt should be laid on the roof and nailed at the edges with roofing nails, each succeeding strip lapped 2 inches.

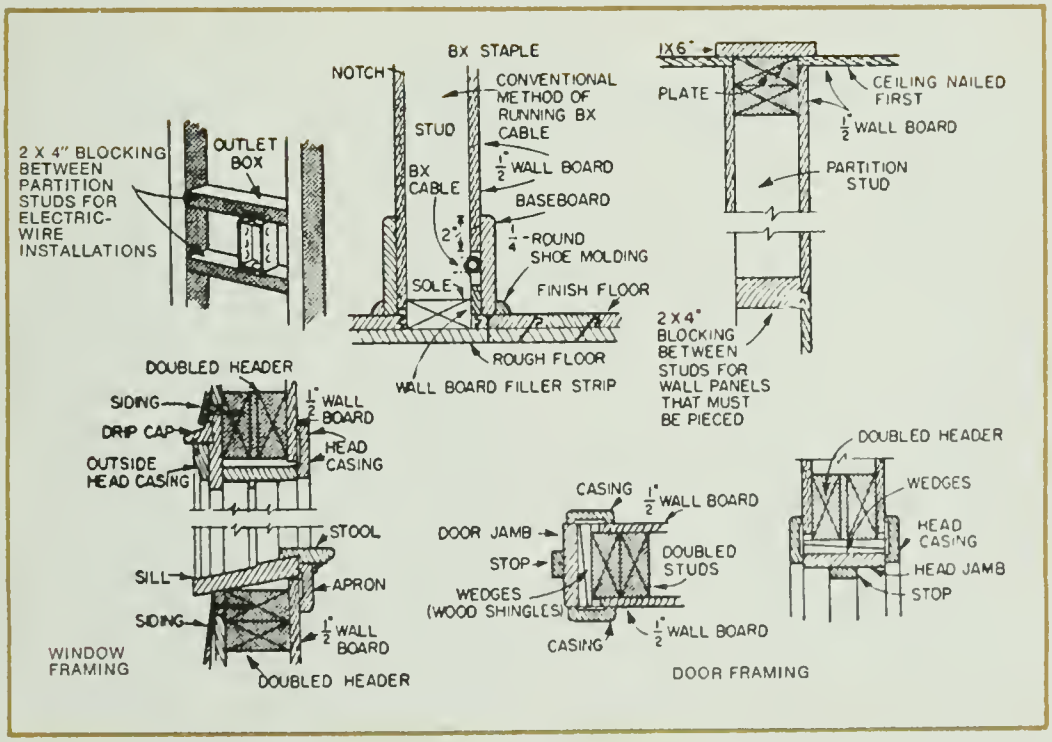
Flashing is necessary at the juncture of new roof and building, and/or at the juncture of new roof and old. If asphalt shingles are used, flashing can be roll-roofing of the same weight. If asbestos or wooden shingles are to be used, metal flashing, usually aluminum, is used. Apply asphalt shingles, which come in a variety of types. Detailed instructions on nailing are furnished with the shingles.

Gutters should be installed with leaders (down-spouts) emptying not less than 36 inches from foundation walls. The better method of installing the gutter is to nail the hangers through the rag felt to the roof boards before shingles are laid. This will prevent possible leaks at the nailing points. However, many a gutter hanger is nailed to the shingle with the nail heads well covered with heavy roofing cement. The least expensive and most easily installed gutter is the slip-joint type of aluminum or galvanized steel. A slope of $\frac{1}{16}$-inch per running foot is minimum for a gutter. To avoid an unsightly slope in a long run, slope your gutter from the center of the run in opposite directions with two outlets and leaders, one at each end of the run.

Cornices and their corresponding rakes (the pitch end) vary, but basically there are three types: box cornice and rake treatment; open cornice; closed cornice. In all but the box cornice, the rake detail is a continuation of the eaves. In the box cornice, simple or elaborate, there's a short continuation of the eaves at the rake called a "return."

The finished upper gable end of houses today is treated in a variety of ways to achieve a more interesting effect than running whatever siding material is used up to the peak. Many houses today also use siding materials of different types in the same


SIMPLIFIED BOX CORNICE
ROOF BOARDS
EDGING STRIP (OPTIONAL)
RAKE
MITERED CORNER
SHEATHING
FRIEZE
BLOCKING
RAFTER
1X4 T&G FINISH LUMBER OR OTHER SIDING MATERIAL
MITERED CORNERS
COVE MOLDING TO CORNER
GUTTER HANGER
SHINGLES
RAFTER
GUTTER SLOPE 1/16" PER FOOT RUN
RETURN
EAVES
FRIEZE RETURN
KEEP GUTTER CLEAR OF EDGE
CROWN MOLDING
BLOCKING FOR SIDING
FRIEZE
PLANCIA
BEVEL SIDING OR OTHER SIDING MATERIAL (#15 FELT UNDER)
EAVES
FRIEZE SIDING
EDGING STRIP
RAFTER
MOLDING
BLOCKING BETWEEN RAFTERS (2X4'S)
EDGING STRIP
RAFTER
CROWN MOLDING
FRIEZE
STUD
FRIEZE
BARGE BOARD (RAFTER)
SHEATHING
STUD
RAKE
PLATE
SHEATHING
FRIEZE
STUD
OPEN CORNICE
MOLDING
RAKE
SIMPLIFIED CLOSED CORNICE
METAL GUTTER (ALUMINUM OR GALV. STEEL)
CLAMP-TYPE HANGER 36" (MIN.) APART
SLIP-JOINT GUTTER
SLIP-ON CAP
OUTLET UNIT
OUTSIDE CORNER UNIT
(ALSO MADE FOR INSIDE CORNERS)
SLIP JOINT CONNECTOR
OUTLET
ELBOW
LEADER (DOWNSPOUT)


2 X 4" BLOCKING BETWEEN PARTITION STUDS FOR ELECTRIC-WIRE INSTALLATIONS
OUTLET BOX
BX STAPLE
NOTCH
CONVENTIONAL METHOD OF RUNNING BX CABLE
STUD
1/2" WALL BOARD
BX CABLE
BASEBOARD
2 1/2"
1/4" ROUND SHOE MOLDING
SOLE
FINISH FLOOR
ROUGH FLOOR
WALL BOARD FILLER STRIP
1X6"
PLATE
CEILING NAILED FIRST
1/2" WALL BOARD
PARTITION STUD
2X4" BLOCKING BETWEEN STUDS FOR WALL PANELS THAT MUST BE PIECED
DOUBLED HEADER
SIDING
1/2" WALL BOARD
DRIP CAP
HEAD CASING
OUTSIDE HEAD CASING
STOOL
SILL
APRON
SIDING
1/2" WALL BOARD
WINDOW FRAMING
DOUBLED HEADER
CASING
1/2" WALL BOARD
DOOR JAMB
STOP
DOUBLED STUDS
WEDGES (WOOD SHINGLES)
CASING
1/2" WALL BOARD
DOOR FRAMING
DOUBLED HEADER
WEDGES
HEAD CASING
HEAD JAMB
STOP

house. Vertical board-and-batten is often used on the gable end, while beveled siding or shingles are used on the balance. Basically, you should use the same siding on your extension as was used on the existing structure, although varying these materials quite often relieves the monotony of only one type of siding material. In contemporary architecture, a variety of materials is often used to accent wings and break up large wall surfaces.

Before interior walls and ceilings can be installed, electrical wiring and fixtures, piping (if any), and heating ducts must be installed. The usual method of stringing BX cable to outlet boxes, etc. is to notch the faces of studs somewhere along the wall face. You may find it to your advantage, however, to run the cable or cables in back of a baseboard. With ½-inch wall material, only a small notch is necessary to clear the cable and, if at any subsequent time the cable must be supplemented, all that is necessary is to remove the shoe molding and baseboard without marring the wall surface. Outlet boxes and the like in walls and ceiling must be supported. Also, if you intend to insulate your walls with blanket or batt insulation, it's done after wiring and piping are in.

You can achieve much the same appearance with plaster or gypsum board, using the taped-joint system as with plaster. Or you can use a variety of fiberboards (which have better insulating properties). The manufacturers of these products recommend V-joints, or some form of batten to cover the joints.

Flooring and interior trim. The finish flooring is dictated by the budget. Oak flooring is durable and makes a beautiful floor. Pine finish flooring, while not quite as hard as oak, makes a good-looking floor and, if the budget demands strict economy, yellow pine T&G sheathing will produce a hard-wearing and interesting floor of the knotty variety. This material, sanded, shellacked with equal parts of orange and white shellac, and given two coats of varnish followed by waxing, produces a floor with character and permanence.

Tile flooring, of various materials, requires a perfectly flat and smooth surface on which to lay the material. This means ¼-inch plywood nailed over the rough floor before tile is laid. Always nail #15 felt over rough flooring before laying a finish floor. In the case of tile, the felt is laid between rough floor and plywood.

To lay finish flooring, allow ¼ to ½-inch space between floor boards and soles on all sides. Start the flooring with the groove toward the sole, and nail the first board along the edges; also toenail at the juncture of tongue, setting the head. Then toenail succeeding boards.

In order to protect the tongue of a floor board from damage when driving its groove over the tongue of the previous board, plane off the tongue of a short piece for a hammering board. Engage the groove of this board in the tongue of the floor board to drive the latter. Finish flooring is sold in random lengths; the better grades, end matched (T&G). Mix in short lengths with long lengths and stagger the joints.

With ceiling, interior wall covering and flooring in place, all that remains for you to complete your room addition is to install the interior trim. This material is available in various styles and sizes. Select trim material that will match or harmonize with the trim in the rest of your home. Install the baseboard, nailing it to the studding and sole plate. Install the window and door trim. Set all nail heads in trim pieces and fill with wood putty. With the exception of interior decorating, which depends upon the type of wall covering used, your room addition is complete and ready for you to move in.

See also: ADDITIONS, HOME; ATTIC; CIRCUITS, ELECTRICAL; CONCRETE; DORMER; GARAGE REMODELING; LUMBER; PLUMBING; ROOFS; WIRING, ELECTRICAL.